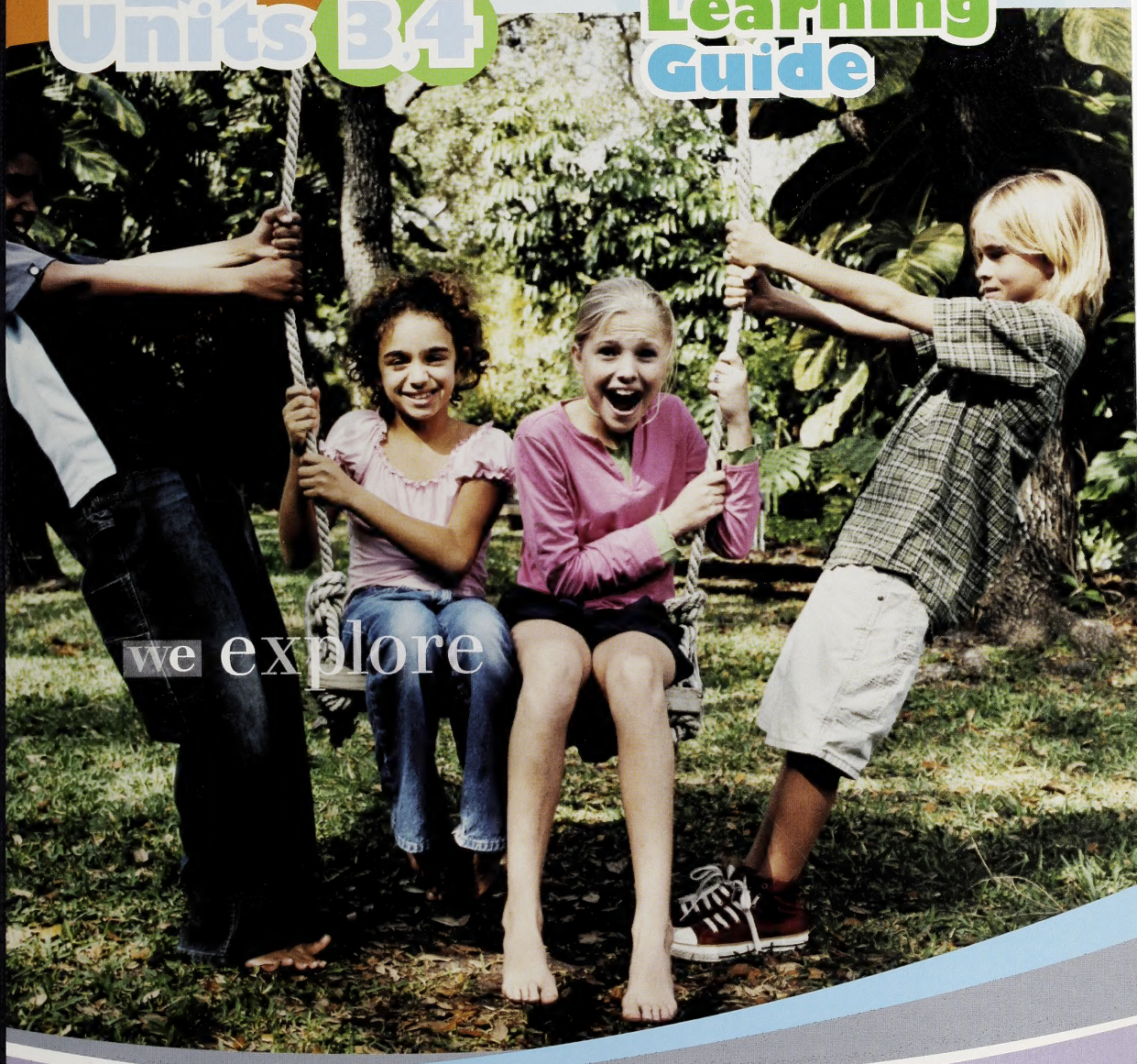
LearnEveryWare

Math 5 Units 3,4

Student Learning Guide



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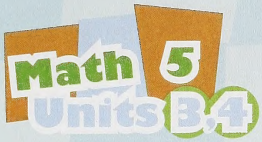

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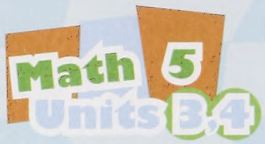

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Math 5 Units 3,4

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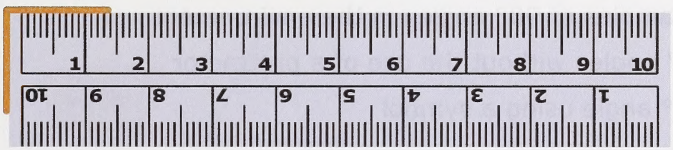
Math 5 Unit 3

Lesson 1

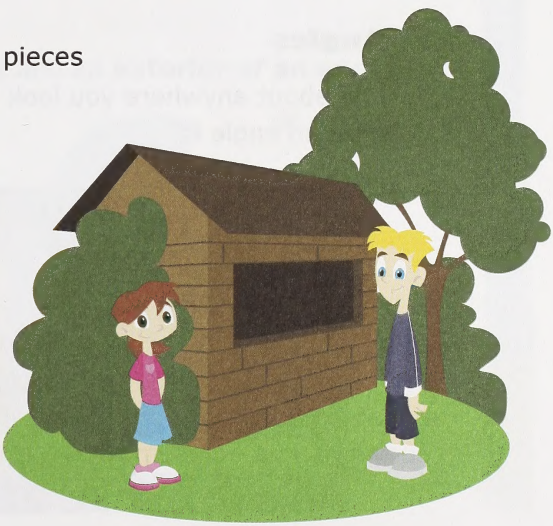
Right Angles

Designing a Fort

Zach and Alyssa are building a fort in the forest near their homes. They are using leftover lumber that their parents gave them. They need to make sure the rails for the fort are square on the corner. Zach has a ruler. He is not sure how he can use the ruler to make the corner square. Alyssa tells him that the ruler is shaped like a right angle on the corner:



They put the ruler between their two pieces of wood to make sure it is square.



Reflection

What if Zach hadn't had the ruler? What else could they do to make sure the corner was square?

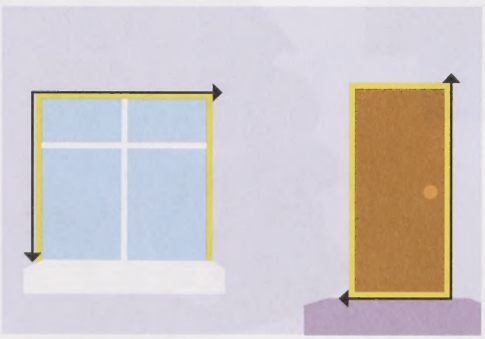
Objectives for this Lesson

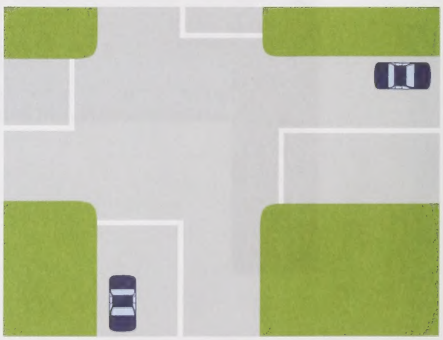
In this lesson you will explore the following concepts:

- Provide examples of 90° angles in the environment
- Sketch 90° angles without the use of a protractor
- Label a 90° angle using a symbol

Angles

Just about anywhere you look you will find an angle. But do you know what an angle is?

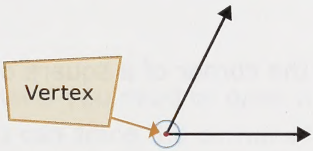




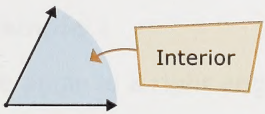
An **angle** is formed by two rays or two line segments that have the same end point.

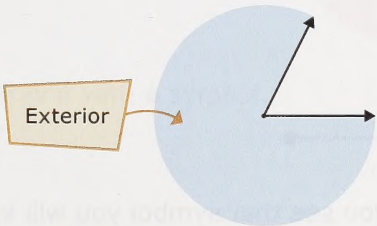
Angle Formed by Two Rays	Angle Formed by Two Segments
	

The common endpoint is called the **vertex**.



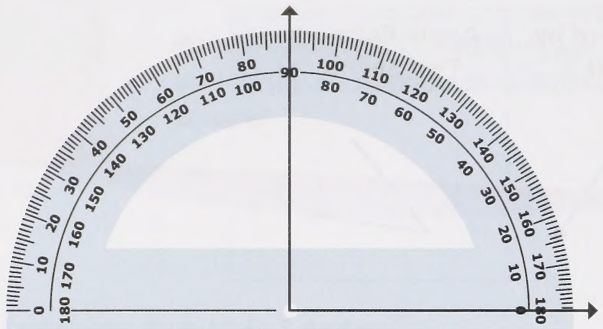
There is also an **interior of an angle** and an **exterior of an angle**.





There are many different types of angles. They are classified by measuring the size of the angle in degrees. This is not the same degree that we use when we measure temperature. To measure an angle you must use a **protractor**.

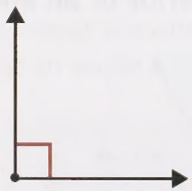
The protractor has units labelled on it. They are similar to the units on a ruler. Study the following image:



The above angle measures 90°. You say "90 degrees" when you read this measure.

As you can see, the 90° angle looks like the corner of a square or a rectangle.

This type of angle is called a **right angle**. When it is a 90° angle a square symbol is drawn on the interior near the vertex.



Anytime you see that symbol you will know that it is a 90° angle.

Now It's Your Turn

Complete the following.

a. Another name for a 90° angle is a _____ angle.

b. An _____ is formed by two rays with the same endpoint.

c. The endpoint shared by two rays is called a _____.

Solutions

a. right

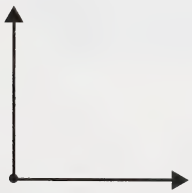
b. angle

c. vertex

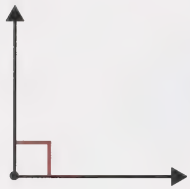
What if you need to draw a right angle? You can trace the corner of a book or even the corner of a cereal box. Lay the book or box down on your paper and then trace on two sides of one of the corners.

Example 1

The angle is a right angle. Label it with a symbol.



Draw a square in the interior of the angle. It should share a corner with the vertex:



- Turn in your Workbook to Unit 3, Lesson 1 and complete 1 to 13.

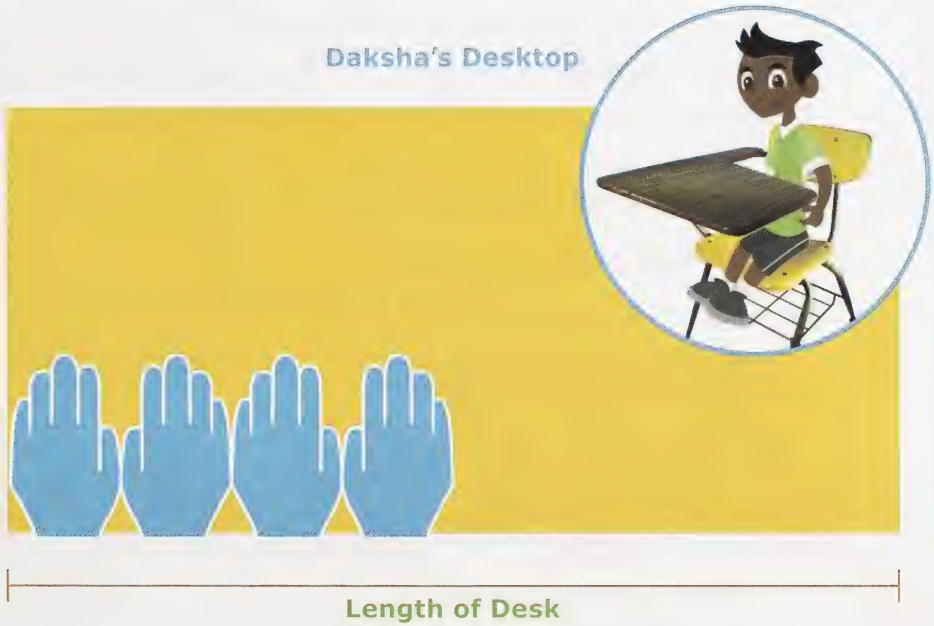
Go online to watch the Notepad Tutor about 45°, 90°, and 180° Angles.

Lesson 2

Measuring Length

How Big is My Desk?

Daksha needed to measure the length of his desk, but he did not have a ruler. He decided to use the width of his hand instead. He laid each hand side by side, moving them all the way across his desk. He counted each hand as he laid it on the desk.



Daksha found out that 8 of his hands would fit across his desk.

Reflection

Do you think that all of the students in his class would get the same answer? Why or why not?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Use personal referents to measure length for the unit mm
- Measure in millimetres
- Describe the relationship between mm and cm units

Measuring with Objects

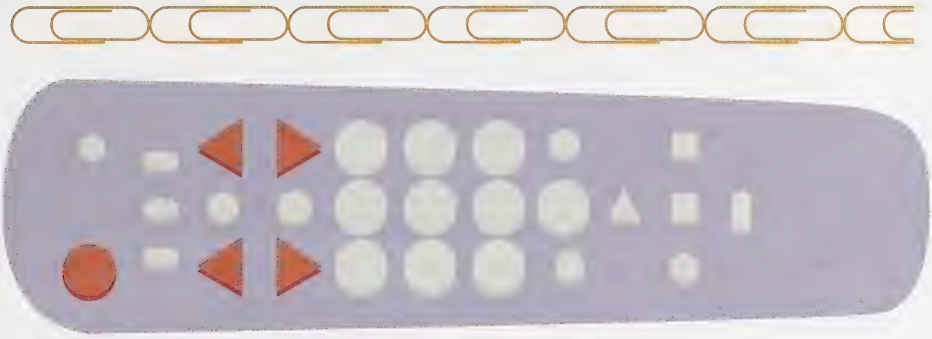
You can measure with many objects.

The pencil is 3.5 Loonies long.

The pencil is 3 paperclips long.

Example 1

What is the length of the remote control in paperclips?



Simply count the paperclips: 6.5 paperclips is the length.

Go online to complete the Concept Capsule about Measuring Length, Width, and Height with Rulers.

Measuring with Standard Units

Daksha used his hand to measure his desk.

Reflection

Why do you think that will not always work?

If Daksha is 10 years old now, how do you think the measure of his desk today will compare to a measure taken 10 years from now?

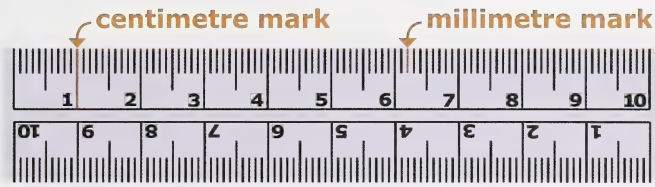
Daksha's Age	Desk in Hand Units
10	8
20	?

What if Daksha isn't around and you need to know the length of the desk? Is it 8 of your hands long? It probably isn't.

In Egyptian times they used body measures as **standard units**. Standard means that if they were trading with another country they would all use the same measure.

Today the metric system is used for standard units.

One of the units you can use to measure the length of objects is the **millimetre**. This is a metric unit. The millimetre is the smallest unit on a metric ruler. On this metric ruler the numbers mark centimetres. The small marks are millimetres.



You can use the millimetre to measure small objects. You may also use them when a very accurate measurement is needed. The abbreviation for millimetre is mm.

The thickness of a Loonie is about 1 mm.

As you can see, centimetres are larger than millimetres. Each centimetre equals 10 millimetres. The abbreviation for centimetre is cm.

10 mm = 1 cm

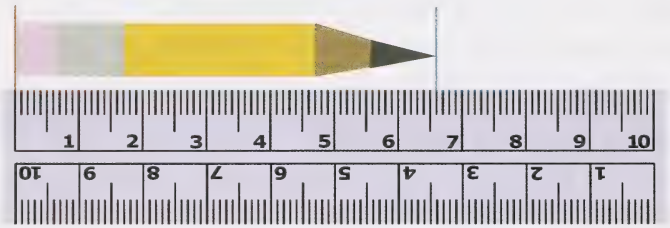
If you know that 10 mm = 1 cm you can conclude that 20 mm = 2 cm.

Every time you see a number on the metric ruler it means a number of centimetres. Simply put a zero after the number and you have the number of millimetres.

To measure a small item you should line it up with the end of the ruler or the first mark of the ruler.

Example 2

How long is the pencil in millimetres?



In the picture, the point of the pencil is after the 6 on the ruler. That means the pencil is at least 60 mm.

There are 6 more marks before the end of the pencil. It is marked in blue here. That means 6 mm.

Put that together to get 60 + 6 millimetres or 66 mm.

You can measure objects in both centimetres and millimetres. Some objects are very small and should be measured in millimetres. If an object is smaller than a centimetre you should use millimetres only. If it is larger than a centimetre you can use either.

Now It's Your Turn

What unit would you use to measure the following objects? Centimetre or millimetre?

a. the diamond in a ring

b. a cell phone

c. height of an action figure

d. a dry lima bean

Solutions

a. mm

b. cm

c. cm

d. mm

Exploration 1: Measuring Small Objects

Materials: Unit 3, Lesson 2, Exploration 1 page from your Workbook, Metric ruler, Five assorted small objects, Pencil, Paper

1. Use your ruler to measure your hand like this:

2. Record the measure in millimetres and in centimetres in the table provided.
3. Use your ruler to measure your hand like this:

4. Record the measure in millimetres and in centimetres in the table provided.
5. Measure your finger like this:

6. Record the measure in millimetres and in centimetres in the table provided.
7. Measure each of your five assorted small objects in both millimetres and in centimetres. Record each measure in the table provided.
8. Compare your measures to those of a friend. Are the measures the same for your hands?
9. Are the measures the same for your objects?
10. Compare the millimetre measure to the centimetre measure. How are they the same? How are they different?

Metre Sticks

A **metre stick** is marked the same as a metric ruler. The difference is that it will go all the way to 100 centimetres. This means when you look at a metre stick you are seeing:

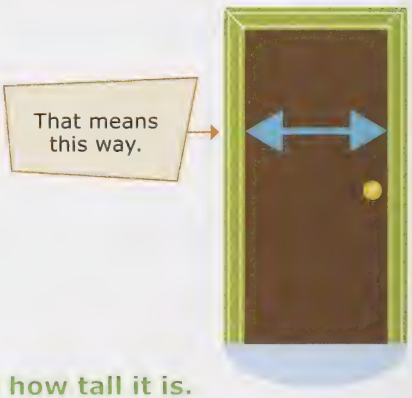
1 metre 100 centimetres 1 000 millimetres

Measuring with a metre stick is done just the same as measuring with a ruler. You may not want to pull it out to measure a paperclip. If you are measuring your desktop or your height it would work better than a ruler.

You can measure objects with a metre stick. Use the exploration to find the measures of things in your environment.

Exploration 2: Measuring Large Objects

Materials: Unit 3, Lesson 2, Exploration 2 page from your Workbook, Metre stick, Pencil, Paper



Measure the width of the door in the room you are in.

1. How many centimetres wide is the door?
2. How many millimetres wide is the door?

Measure the window in the room. Record how tall it is.

3. How many centimetres tall is the window?
4. How many millimetres tall is the window?

Find two objects in the room that you are in that are about 1 metre or less. Use the metre stick to measure the object and find the exact measurement.

5. How many centimetres is the first object?
6. How many millimetres is the first object?
7. How many centimetres is the second object?
8. How many millimetres is the second object?
9. How do your measurements compare to those of a friend?
10. How do your millimetre measurements compare to your centimetre measurements?

Example 3

What would you use to measure each object: a metre stick or a ruler?

A. rug B. marble C. watch face D. your height

Think: Is the object smaller than a ruler or larger than a ruler?

Smaller than a ruler: marble and watch face

Larger than a ruler: rug and your height

A ruler would be used to measure objects that are smaller. Use a metre stick for anything larger.

The answers are:

A. metre stick B. ruler C. ruler D. metre stick

Let's Practice

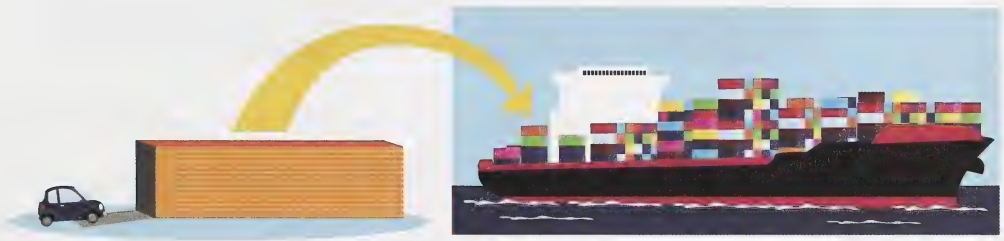
- Turn in your Workbook to Unit 3, Lesson 2 and complete 1 to 19.

Lesson 3

Measuring Volume

Shipping Cars

Each day cars are packed into containers and placed on large ships to be delivered to places all over the world. It is really important to get as many cars into the containers as possible. The car manufacturers ask the question "How many cars will fit in the container?"
Look at the following illustration.



Reflection

How many cars do you think will fit? How many containers do you think will fit on the ship? What do you need to know to answer these questions?

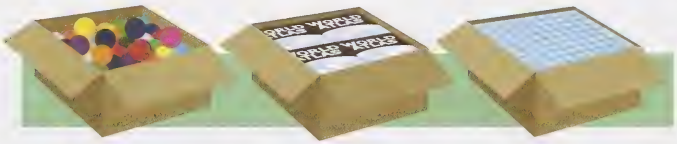
Objectives for this Lesson

In this lesson you will explore the following concepts:

- Use personal referents to measure volume in cubic centimetres or cubic metres
- Estimate volume using cm^3 or m^3
- Measure and record volume using cm^3 or m^3 units

Volume

Volume is the amount of space a solid occupies. You can use volume to tell you how much of something will fill a container.



You can fill a container with anything. What do you think will fill the box better: the balls, the books, or the cubes?

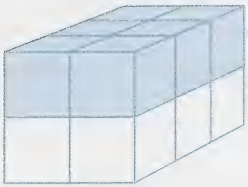
The balls leave spaces in the box. They will not fill the space completely. The books and the cubes can fill the space completely. The books are much larger than the cubes. The cubes will give a more accurate measure since they are smaller.

Example 1

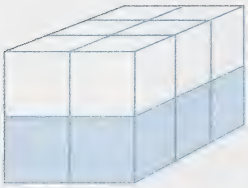
Cameron fills a small box with sugar cubes. If you look at the cubes alone you will see:

What is the volume of the box in sugar cubes?

Count the cubes on the top layer:



The same number of cubes is on the bottom:



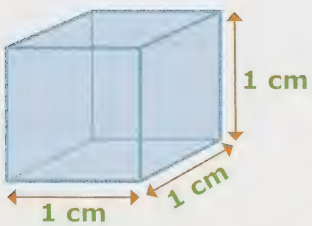
That is a total of 6 + 6 cubes = 12 sugar cubes.

The volume of the box is 12 sugar cubes.

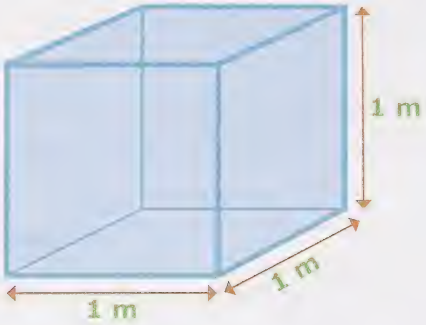
Centimetre Cubes

Instead of saying that a box will hold 12 books, we say it has a volume of 25 **cubic centimetres**. Volume is measured in units such as cubic centimetres (cm^3) or **cubic metres** (m^3).

A cubic centimetre is 1 cm x 1 cm x 1 cm:



A cubic metre is just like a cubic centimetre only it is bigger.
It is 1 m x 1 m x 1 m.



Choosing Units

When measuring the volume of an object you will need to choose a cubic unit as your measure.

Your choices are mm^3, cm^3, m^3 and km^3.

Example 2

Alyssa has purchased a basketball to give to her friend for his birthday and she needs to wrap it in a box. She is going to the store to get the wrapping supplies she needs. What unit should she use to measure the box?

A. mm^3 B. cm^3 C. m^3 D. km^3

1. Narrow your choices by deciding which units you cannot use.

   Kilometres measure very large items and millimetres measure very small items. That reduces your choices to B and C.

   ~~A. mm^3~~ B. cm^3 C. m^3 ~~D. km^3~~

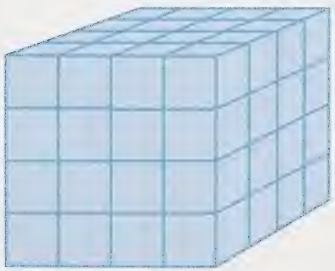
2. Evaluate the two choices that are left.

   Centimetres and metres are the choices left. Metres are used to measure large items like a person's height. In Lesson 2 you measured the height of a door in metres. A basketball is not large enough to be measured in metres. Centimetres would be the best choice.

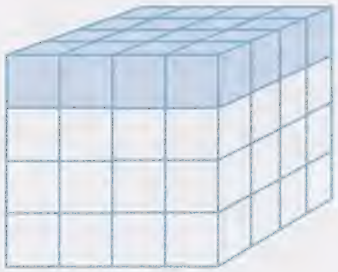
~~A. mm^3~~ B. cm^3 ~~C. m^3~~ ~~D. km^3~~

Example 3

What is the volume of the cube?

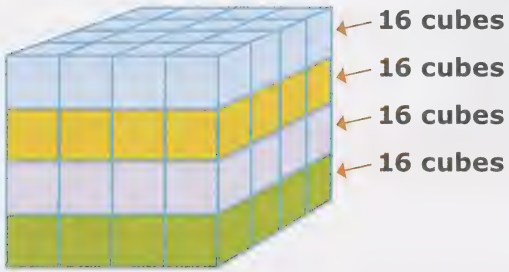


1. Count the number of cubes on the top layer.



There are 16 cubes on the top layer.

2. The remaining layers each have the same number of cubes.

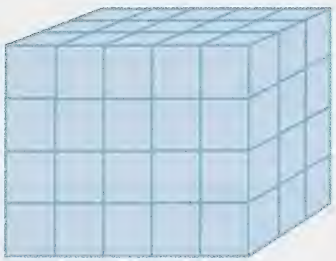


3. Add up all the layers: 16 + 16 + 16 + 16

The volume is: 64 mm^3

Example 4

Lian says she has a new way to find the volume of a solid.
For this rectangular solid made of centimetre cubes, she has used the method shown:



The top layer:
3 x 5 = 15

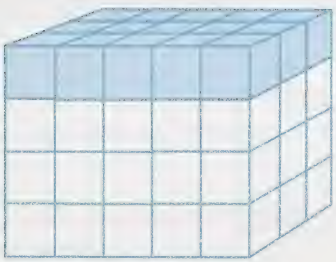
There are 4 layers:
4 x 15 = 60

The answer is 60 cm^2

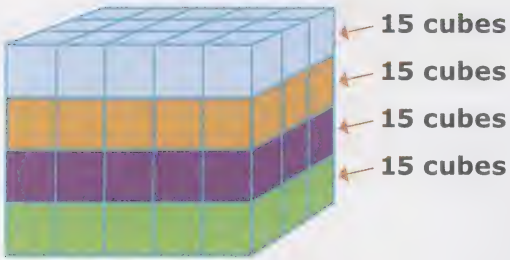
Is Lian right? Will the volume be 60 cm^3 using the other method?

Check Lian's answer by counting one layer at a time:

The first layer is 15 cubes.



Each additional layer is 15 cubes.



Now add up the layers: 15 + 15 + 15 + 15 = 60

The volume is: 60 cm^3

Reflection

So Lian is right! Why?

Let's compare:

The Top Layer:
15 Cubes

Counting works but Lian noticed that the top layer is an array model of 3 x 5.

The Top Layer:
3 x 5 = 15

Each Additional Layer:
3 more layers with
15 cubes each

Add Up The Layers:
15 + 15 + 15 + 15 = 60

Repeated Addition and Multiplication are the same.

There Are 4 Layers:
4 x 15 = 60

The answer is 60 cm^3.

Same result

The answer is 60 cm^3.

- Turn in your Workbook to Unit 3, Lesson 3 and complete 1 to 10.

Estimating Volume

You might estimate the volume of a container when you are trying to decide:

- how big a box needs to be to mail items to your family.
- how large a container needs to be to store your video games.

Reflection

How can you use parts of your body to estimate volume?

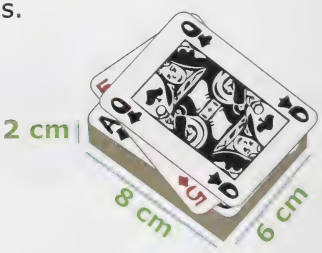
Example 5

Zach needs a box to keep his favourite card game in when he is not playing it. In which box do you think that he would need to store his cards?

Box 1: 100 cm^3 Box 2: 1 m^3

First, determine about how large the deck of cards is.

Think about how large a normal playing card is. It is about 8 cm x 6 cm. A stack of playing cards is about 2 cm thick.



Next, choose between the two box sizes by comparing the size of the cards to each unit size.

Box 1 is measured with centimetre cubes. Box 2 is one metre cube. Metres are much larger than centimetres. Box 2 would be way too big!

Box 1 would be the best choice for storing the cards.

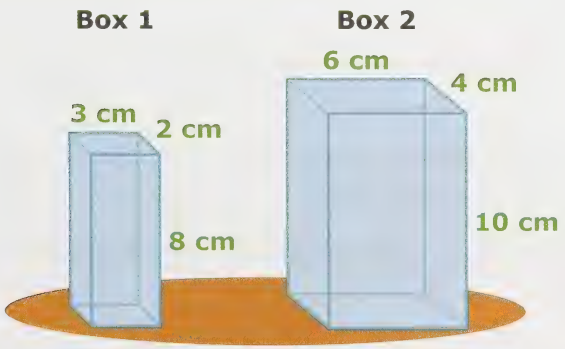
Exploration 1: Packaging the Gift

Materials: Unit 3, Lesson 3, Exploration 1 page from your Workbook, 5 sheets of centimetre grid paper, Paper, Tape, Scissors, Pencil

Daksha made a sculpture in art class for his mother. He wants to wrap it and give it to her for her birthday. The sculpture is 9 cm tall, 4 cm long and 3 cm wide.

He is trying to decide which box to use to put the sculpture in. He will need extra room to add packing materials to protect the sculpture. Here are his box options:

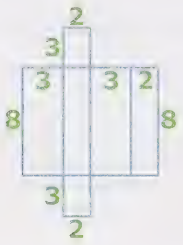
Which box should he use?



1. Draw the first box by drawing Net A on your centimetre grid paper. Remember, each square on the paper represents a square centimetre.

Net A:

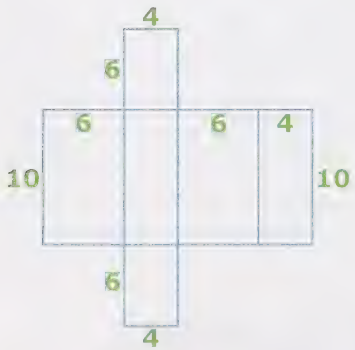
Box 1



2. Draw the net of the second box on grid paper using Net B. You will need to tape sheets of grid paper together to make it large enough for this figure.

Net B:

Box 2



3. Cut out each net and fold to form the box. Use tape to hold it together.

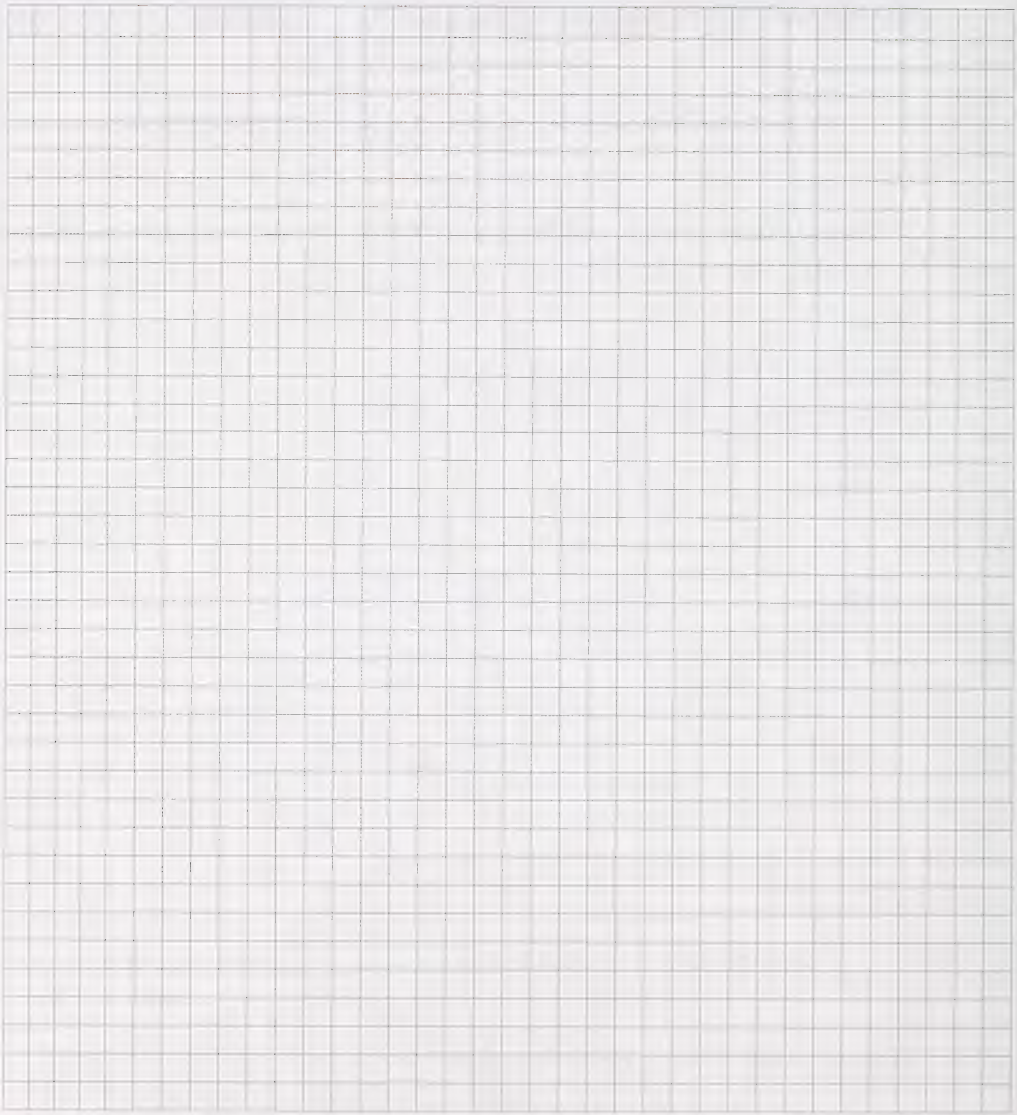
4. Decide which box would hold the sculpture by finding the volume of the sculpture and also of both boxes.

5. Describe the method you used to determine which box will hold the sculpture.

Let's Practice

- Turn in your Workbook to Unit 3, Lesson 3 and complete 11 to 24.

Go online to watch the Notepad Tutor about Determining Volume Using a Formula.



Lesson 4

Capacity

Cooking

Nina is making almond nut bread with her father.
Her dad tells her to measure 80 mL of orange juice and 120 mL of water.

Nina uses a measuring cup to measure both ingredients.

Reflection

How did Nina know how far to fill the cup?
How much is 120 mL?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Describe the relationship between mL and L
- Select and justify referents for mL or L units
- Estimate capacity
- Measure and record capacity

Capacity

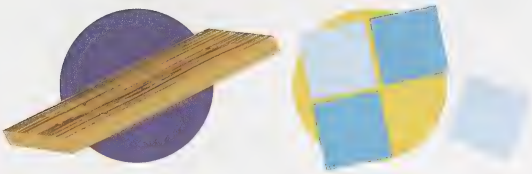
Capacity is the amount that a container can hold. It usually measures liquids or substances that take the shape of the container they are poured into. Some examples of these substances are sand and rice.

Example 1

Which of the following substances would be measured as capacity?

a. water b. milk c. lumber d. tiles

Lumber is measured with length and tiles are measured as area.



Water and milk are both measured as capacity.

a. water b. milk c. ~~lumber~~ d. ~~tiles~~

The most commonly used units for capacity are millilitres and litres.

The **graduated cylinder** and measuring cups are two types of commonly used measuring devices for capacity.

The abbreviation for litre is L and for millilitres is mL. There are 1 000 millilitres in a litre.

Capacity
1L = 1 000 ml

Some common litres are:

One Litre of Water

One Litre of Milk

One Litre of Ice Cream

Litres are the standard unit for capacity. You can also measure smaller amounts using millilitres.

Some common items measured in millilitres are:

10 mL of Medicine **250 mL of Jam** **450 mL of Shampoo**

Choosing Units and Estimating

When you need to measure a liquid or substance that fits in a container you will need to choose which unit to measure with: millilitres or litres.

Example 2

Cameron needs to give his new kitten some medicine. Would he need to measure the medicine in millilitres or litres?

Can you imagine taking a LITRE of medicine? When you think of a litre, think of a litre bottle of water.

Medicine is usually measured in millilitres.

Millilitres are used for small, very accurate measurements. Kittens are very small; therefore, they would need very small amounts of medicine. Millilitres are the best choice for measuring medicine.

Example 3

Which measure is the closest to the amount of water in the fish tank shown?

A. 500 millilitres B. 1 litre C. 50 litres D. 10 000 litres

Reflect: Think of items that are measured in millilitres. A fish tank is a lot larger than anything you are probably thinking of. That means you can cancel choice A.

A litre bottle of water is not going to fill a fish tank. Cancel choice B.

Your last two choices are 50 litres or 10 000 litres. If you take your 1 litre water bottle and fill the tank with it, how many will it take? 50 or 10 000? If you said 50 then you are right. 10 000 litres would be way too many.

The answer is: C. 50 litres

Let's Practice

Go online to complete the Concept Capsule about Estimating Capacity Using Referents for mL and L.

- Turn in your Workbook to Unit 3, Lesson 4 and complete 1 to 14.

Measuring and Recording Capacity

It is very important to measure and record your data accurately. Imagine that you are measuring ingredients for a recipe. It can really change the way food tastes with even a small mistake when measuring.

Measuring is like everything else—it takes practice to do it well. So now it's your turn to try!

Let's Explore

Exploration 1: Measuring Capacity

Materials: Unit 3, Lesson 4, Exploration 1 page from your Workbook, Set of graduated cylinders (10 mL to 1 000 mL), A pitcher of water, Pencil

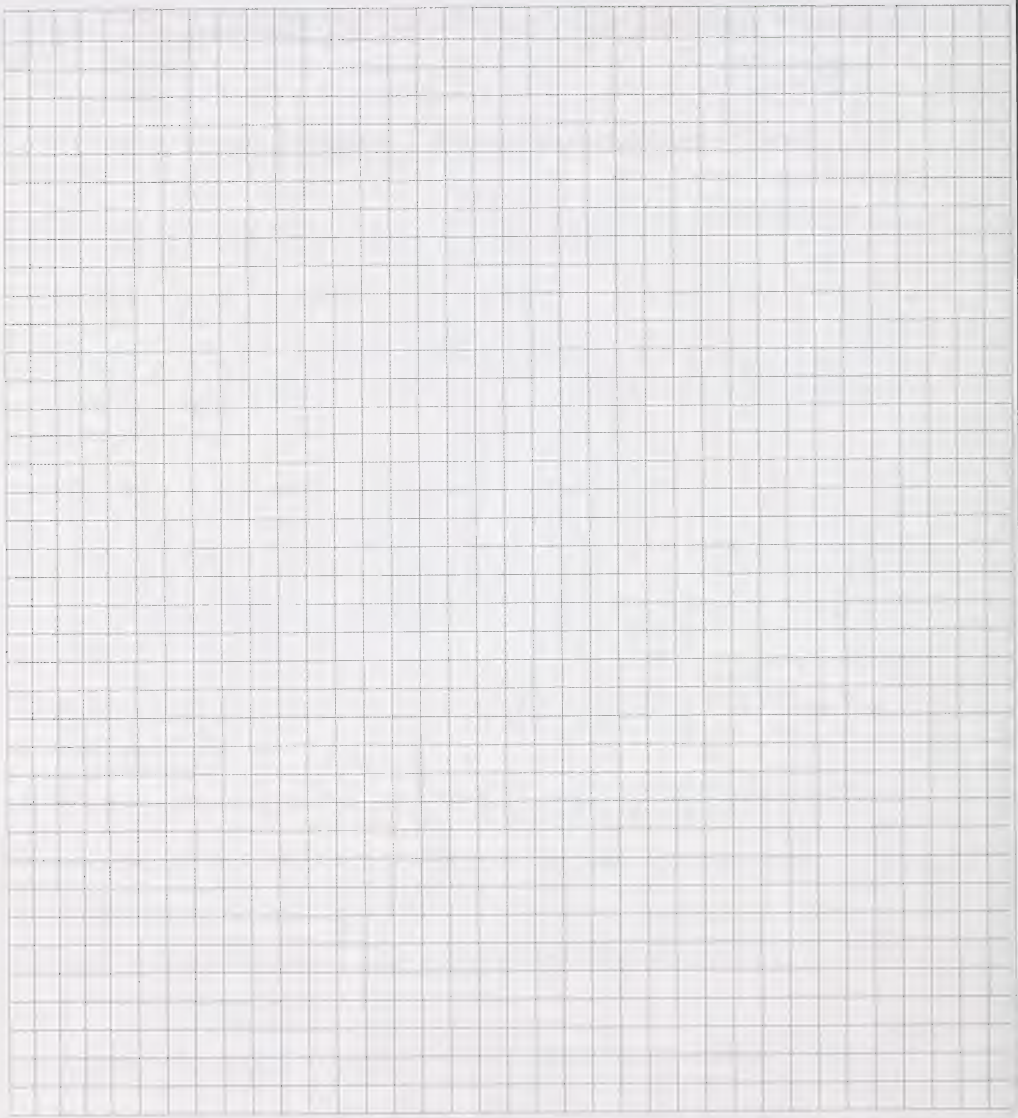
1. Use the 10 mL graduated cylinder. Fill the cylinder to the 10 mL mark.

   This may take some practice. Pour the water back into the pitcher and try it two or three times until you get it exactly right a few times in a row.

2. Pour 10 mL into the 50 mL cylinder. Repeat until it is full.
3. How many 10 mL cylinders did it take to fill up the 50 mL cylinder?
4. How many 50 mL cylinders do you predict it will take to fill up the 500 mL cylinder?
5. Pour 50 mL into the 500 mL cylinder. Repeat until it is full to test your prediction.
6. If you were wrong in your prediction, describe the difference.
7. How many 500 mL do you predict it will take to fill up the 1 000 mL cylinder?
8. Pour 500 mL into the 1 000 mL cylinder. Repeat until it is full to test your prediction.
9. If you were wrong in your prediction, describe the difference.
10. Describe the relationship between the graduated cylinders.

Let's Practice

- Turn in your Workbook to Unit 3, Lesson 4 and complete 15 to 25.



Lesson 5

Rectangles and Perimeter

Routes

Alyssa is going to visit Zach. After visiting Zach, she decides to go to the library. From the library she comes home, completing the rectangular route.

Alyssa walks two kilometres on one block and four kilometres on the other block.

Reflection

How far did Alyssa walk on her route? What concept does this model?

You can use the **properties** of rectangles to solve problems involving **perimeter**.

Reflection

Do you remember the properties of rectangles?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Draw a rectangle for a given perimeter
- Draw rectangles for a given perimeter in word problems

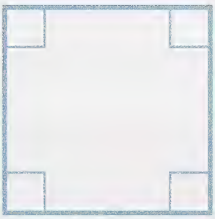
Rectangles

Rectangles are everywhere. It is a shape that we use or see many times a day. What shape is your textbook? What shape is your desktop? What shape are most doors? Everywhere you look you will find rectangles.

Can you define the word rectangle? A rectangle is a **parallelogram** with four right angles.

A parallelogram has opposite sides that are **congruent** and **parallel**.

A rectangle is a special parallelogram that has four right angles:



You may recognize the second rectangle here as a square. A **square** is a special rectangle with all four sides congruent.

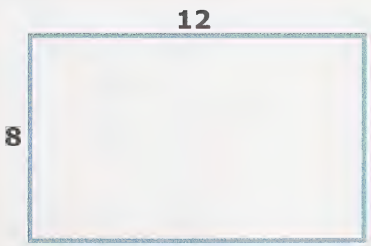
Example 1

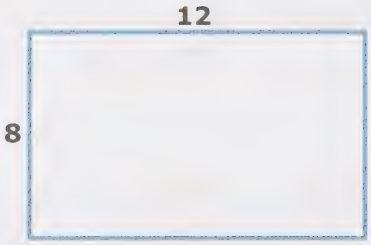
For the rectangle shown:

a. Mark all angles as right angles.

b. Mark the missing sides with their measures.

c. Find the perimeter.





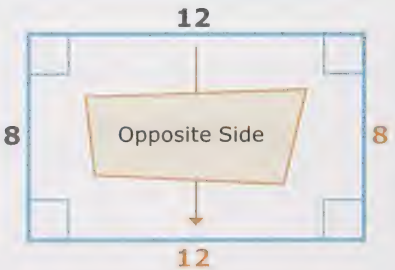
a. Mark all angles as right angles.

Since you know this is a rectangle, you know that the angles are all right angles.

The symbol for a right angle is a square in the corner of the angle:

b. Mark the missing sides.

Use the attribute: opposite sides are congruent.



c. Find the perimeter.

The perimeter of the rectangle is the distance around.
You need to add the sides:
12 + 8 + 12 + 8 = 40

The perimeter is 40.

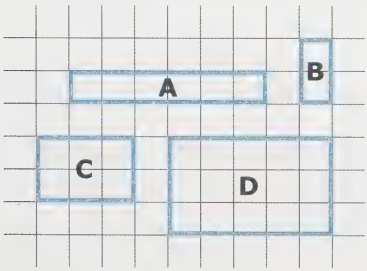
Drawing Rectangles

You can draw a rectangle with a specific perimeter. Remember, you have two pairs of sides that have the same measure.

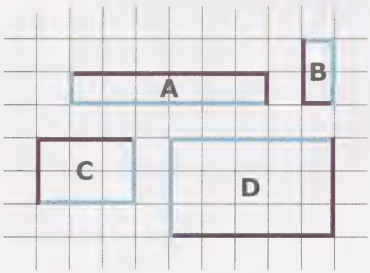
Exploration 1: Rectangles of a Given Perimeter

Materials: Unit 3, Lesson 5, Exploration 1 page from your Workbook, One piece of centimetre grid paper, Pencil, Pencil crayons or crayons

On your grid paper draw the following with your pencil:



Now, use a colour to outline two sides that have different measures:



Now look at the sum of the two sides you coloured and the sum of the other two sides:

Rectangle	Sum of Coloured Sides	Sum of Other Two Sides	Perimeter
A	7	7	14
B	3	3	6
C	5	5	10
D	8	8	16

1. On your grid paper, create three more rectangles where the sum of the two sides equal 4, 6, and 9.
2. What do you notice about the sum of the two different sides and the sum of the other sides?
3. How does the perimeter relate to the sum of the two different sides?
4. Reflect: How can you use this information to help you draw rectangles for a given perimeter?

Example 2

Daksha needs to draw a rectangle with a perimeter of 30 cm. What is the length and width of the rectangle?

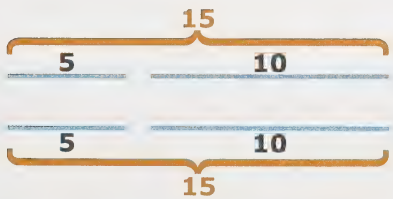
You know that the sum of the two different sides and the sum of the other two sides are the same. Start with four segments that represent your sides:

Each pair of lines represents the same amount of length. The perimeter is 30. This means that half of your 30 will be the sum of each pair:

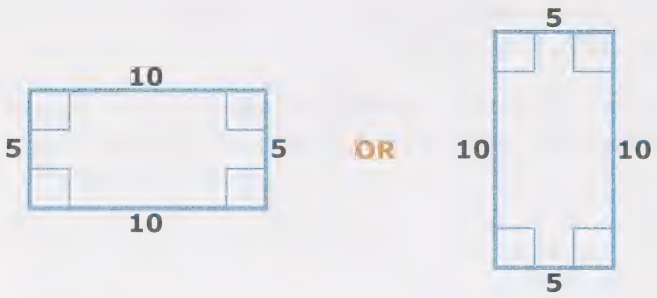
Now you can decide on any two numbers that have a sum of 15:

1 + 14 2 + 13 3 + 12 4 + 11 5 + 10 6 + 9 7 + 8

There are 7 pairs that have a sum of 15. Here, the choice is to use 5 + 10:



Now put that together as a rectangle:



The rectangle can be positioned either way.

It may help you to draw your rectangle on centimetre grid paper. That way you can see the length of the units on each side.

Exploration 2: How Many Drawings?

Materials: Unit 3, Lesson 5, Exploration 2 page from your Workbook, Pencil, Pencil crayons or crayons, Grid paper

1. Nina and her grandfather bought 20 metres of wood to fence a section of her yard for her dog. How many different rectangular enclosures can they make with the materials?

2. Use the grid paper to draw all possible enclosures for the fence. Record the side lengths in the table.

Example 3

Cameron has a 40 cm piece of wood. He wants to cut it to form a rectangular frame. Draw 4 possible frames for the materials.

Two sides should have a sum of half of the 40 cm piece of wood: 20

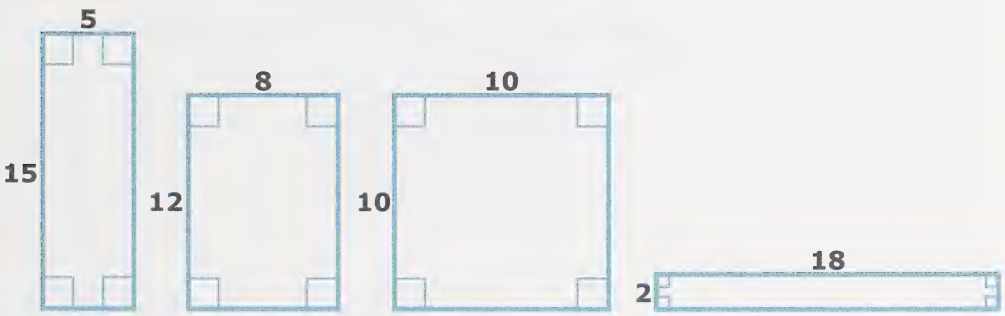
List several pairs of numbers that add up to 20.

Here are all of them:

1 + 19	2 + 18	3 + 17	4 + 16	5 + 15
6 + 14	7 + 13	8 + 12	9 + 11	10 + 10

Choose four of these pairs to form your rectangles.

One possible solution is:



Let's Practice

Go online to watch the Notepad Tutor about Problem Solving Using Perimeter.

- Turn in your Workbook to Unit 3, Lesson 5 and complete 1 to 13.

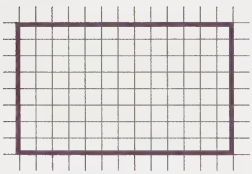
Lesson 6

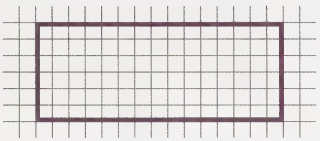
Area

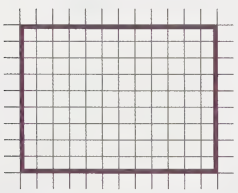
Building with Blocks

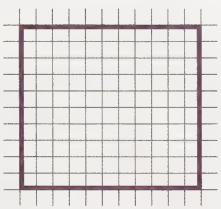
Lian is making a fort for her action figures out of building blocks. She has 42 cm blocks. She wants to have the largest area possible. How can she arrange her blocks in a rectangle that gives the largest area?

Lian knows that there are a lot of rectangles that she can make with the perimeter of 42 cm. She builds her fort with these side measures and puts them on grid paper:









Lian decides that the fort that will give her the greatest area is 10 cm by 11 cm. The perimeter is 42 centimetres and the area is 110 cm^2.

Reflection

Is there a way to predict the rectangle that will always have the greatest area?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Draw two or more rectangles for a given area
- Determine the shape with the greatest area for a given perimeter
- Determine the shape with the least area for a given perimeter

Rectangles

In Lesson 5 you learned that a rectangle is a parallelogram with four right angles. A square is a special rectangle that has 4 congruent sides.

Parallelogram **Rectangle** **Square**

In this Lesson you will use your knowledge of rectangle attributes to find the area of a rectangle.

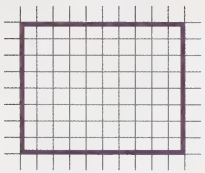
Go online to complete the Concept Capsule about Estimating Area Using Concrete and Pictorial Representations (mm, cm and m).

Area

You learned that perimeter is the distance around a figure. Now you are going to learn about area. The definition of **area** is the number of square units needed to cover a flat surface.

Area is used to measure many things. What if you need to buy carpet for your bedroom? You need to know how many square metres are in your bedroom. You will buy the correct amount of carpet for the floor if you know this measure.

If your bedroom is 10 metres long and 8 metres wide you can use grid paper to help you find the area. Let each square equal one square metre.

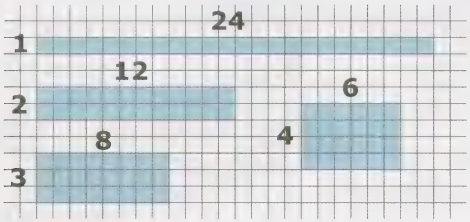


Count the squares inside the grid to find A = 80 m^2. That is the number of square metres in your room.

Example 1

Alyssa and her grandmother are going to make a garden. They have enough fencing to surround an area of 24 m^2. How many different rectangles can they make that have an area of 24 m^2?

Begin by drawing all possibilities on grid paper. Remember, the area must be 24 m^2 and it must be shaped like a rectangle:



The answer is: Alyssa and her grandmother can make 4 different rectangles with an area of 24 m^2.

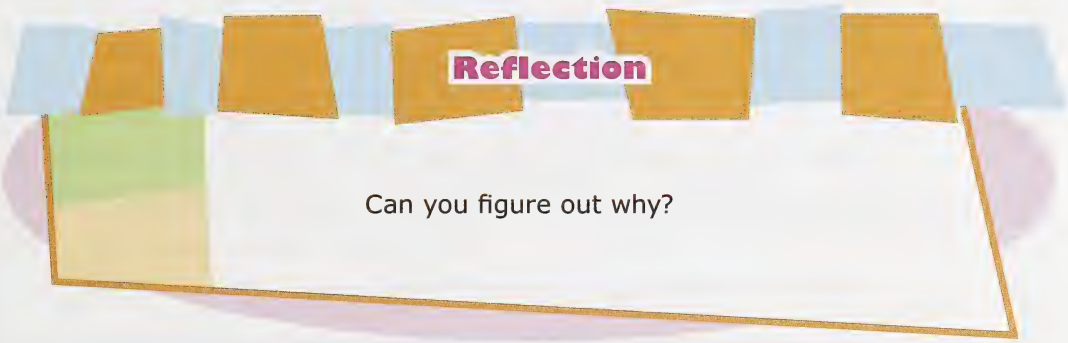
Reflection

Did you find any others?

You shouldn't be able to. Notice that one of the two sides is increasing in order:

Side 1	Side 2	Area
1	24	24
2	12	24
3	8	24
4	6	24

Can the area of 24 m^2 be formed with one side length of 5? You can try but you will not find one.



Area and Perimeter

Many people confuse area with perimeter. There is a rhyme that you can remember to help you:

"Perimeter, perimeter, the distance around.
Area, area, what's on the ground."

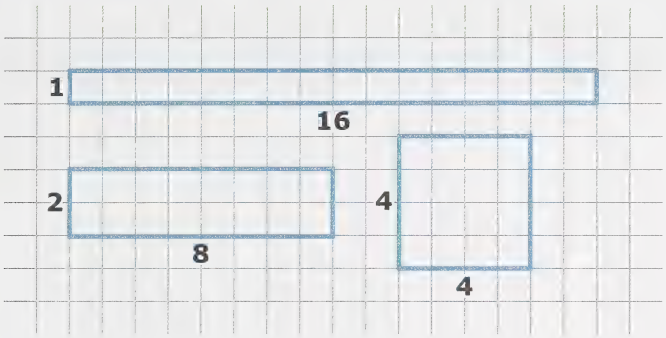
You need to explore the relationship between perimeter and area. This exploration will let you think about that.

Exploration 1: Area and Perimeter

Materials: Unit 3, Lesson 6, Exploration 1 page from your Workbook, 4 sheets of Centimetre grid paper, Pencil

1. Create all rectangles that have a perimeter of 16 on the centimetre grid paper.
2. Record the side lengths, perimeter and area of each rectangle.
3. Create all rectangles that have a perimeter of 24 on the centimetre grid paper. You may need to tape two sheets of grid paper together for this.
4. Record the side lengths, perimeter and area of each rectangle.
5. What do you notice about the relationship between the side lengths as the area gets larger?
6. What do you notice about the relationship between the side lengths as the area gets smaller?

The following shapes all have an area of 16. Do they have the same perimeter?



7. Find the perimeter of each figure.
8. Complete the table in your workbook for the given figures.
9. Create all rectangles that have an area of 36 cm^2 on your grid paper. You may need to tape two sheets of grid paper together for this.
10. Find the perimeter of each and record all values in the table given in your workbook.
11. What do you notice about the relationship between the side lengths as the perimeter gets larger?
12. What do you notice about the relationship between the side lengths as the perimeter gets smaller?

Let's look at Alyssa's garden again. In your first design you were asked to draw as many rectangles as you could with an area of 24 m^2. Now let's design it in a different way.

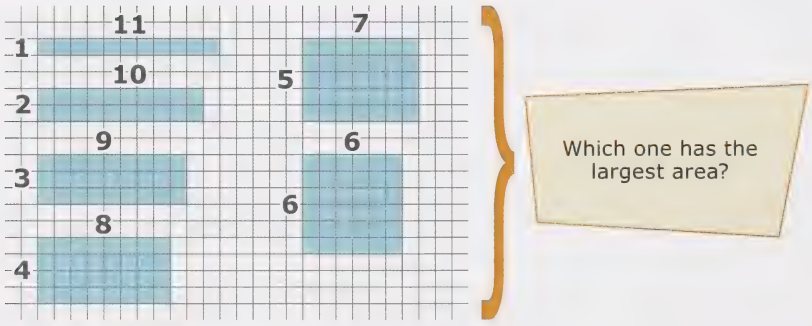
Example 2

Alyssa has 24 m of fencing. How can she make the biggest area for her garden?

Create or list all of the possible side lengths that form a perimeter of 24 m.

List: 1 and 11
2 and 10
3 and 9
4 and 8
5 and 7
6 and 6

Create:



You can make a table for the values since you will have to compare them in the end:

Side 1	Side 2	Perimeter	Area
1	11	24	11
2	10	24	20
3	9	24	27
4	8	24	32
5	7	24	35
6	6	24	36

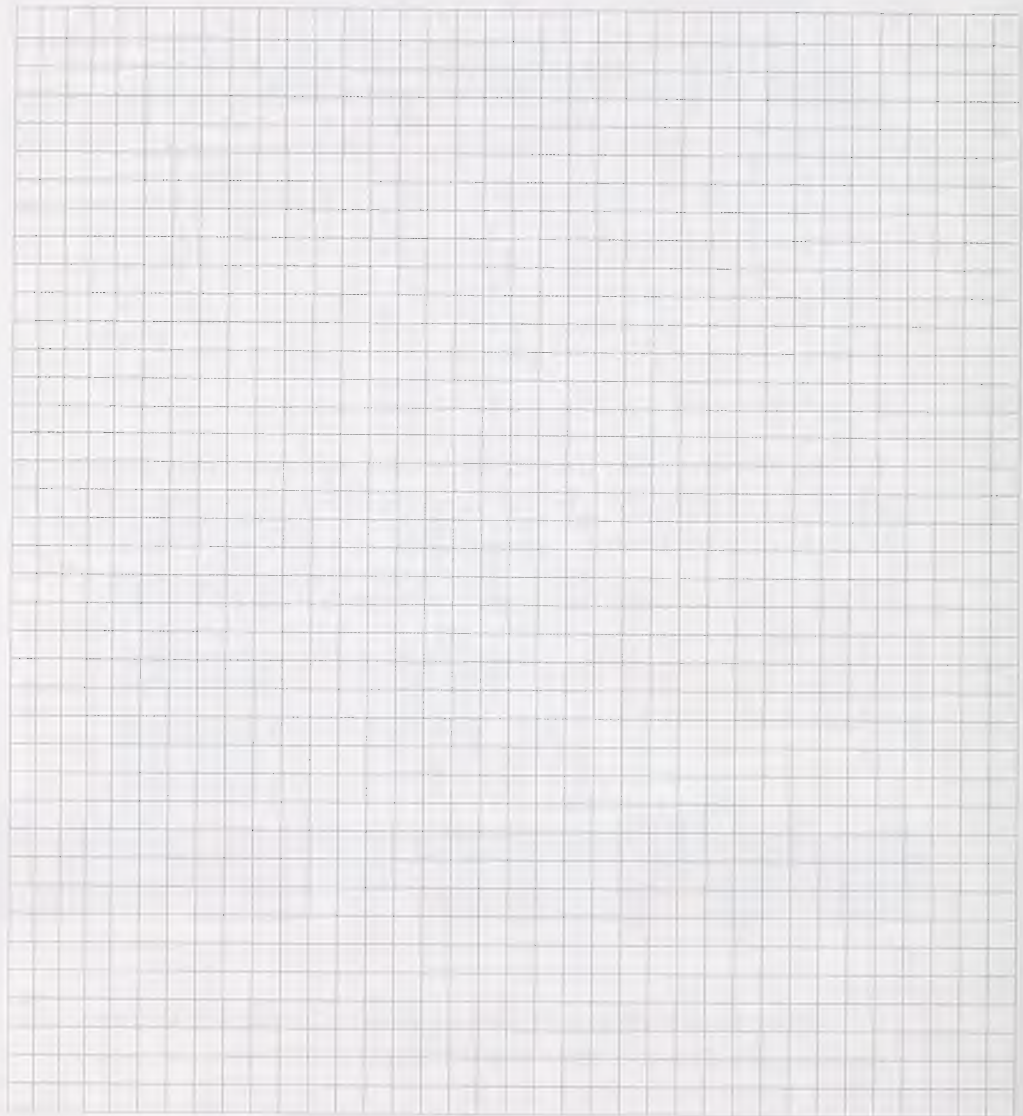
You should notice that the largest area is 36 square metres and it is in the shape of a square. The side lengths have the smallest difference of all the side lengths given.

So how can she make the biggest area for her garden?

Alyssa needs to make a square with 6 metres on each side.

Go online to watch the Notepad Tutor: Construct Different Rectangles Given Either the Perimeter or Area.

- Turn in your Workbook to Unit 3, Lesson 6 and complete 1 to 12.



Lesson 7

Properties of 2-D Shapes

Skiing

Lian was teaching her little cousin to ski.

Lian told her cousin to "Keep your skis parallel to one another at all times."

Her cousin looked at her and said, "What is parallel?" Lian showed her how to position her skis like this:

Her cousin was still not quite sure when later she said, "Turn your skis to stop."

Her cousin said, "You mean like this?"

Lian said, "No, you need to keep them parallel. That is intersecting."

Lian's cousin got the hang of it really quickly and was able to ski down the beginner slope without falling on the first day.

Reflection

Why did Lian's cousin think that "turn your skis" meant to put them in an X?

Objectives for this Lesson

In this lesson you will explore the following concepts:

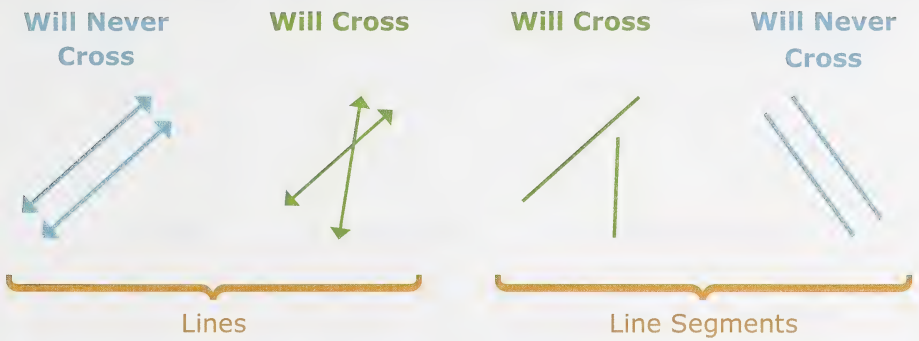
- Identify parts of polygons that are parallel, intersecting, and perpendicular
- Describe vertical and horizontal
- Provide examples from the environment of segments that are parallel, intersecting, perpendicular, vertical, and horizontal

Parallel

A **line** is a straight path that goes on forever in opposite directions.

A **line segment** is part of a line that has two **endpoints**.

You can describe lines or line segments as parallel if they will never cross.



Example 1

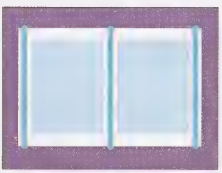
Find some examples of line segments in your home that are parallel.

You can look around the room you are in and find any of these things:

Door:

Bed

Window



Two-dimensional shapes have sides that are made up of line segments. The segments can be parallel. Here are some quadrilaterals with parallel sides marked in orange:

Parallelogram

Rectangle

Square

Trapezoid

Polygons are closed shapes that have no lines that cross. Here are some polygons you have seen before:

Pentagon

Hexagon

Octagon

Example 2

Connect the endpoints of the line segments given to form a polygon.

a. Name the polygon.

b. Are the new segments parallel?

Answer:

a. This is a five-sided figure so it is a pentagon.

b. The new segments are NOT parallel.

Intersecting Segments

Lines and segments that are **intersecting** will cross.

Intersecting Line Segments

You may not be able to tell if two segments are parallel or intersecting just by looking at them. What you can do is trace them on your own paper and use a ruler to extend the lines to test.

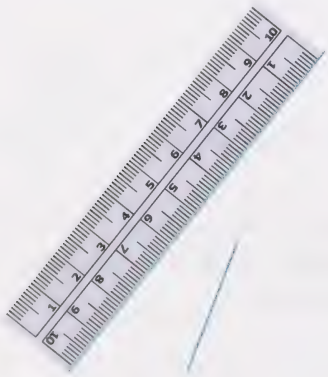
Let's Explore

Exploration 1: Parallel lines

Materials: Unit 3, Lesson 7, Exploration 1 page from your Workbook, Paper, Pencil, Ruler

1. Trace the following line segments on your own paper.

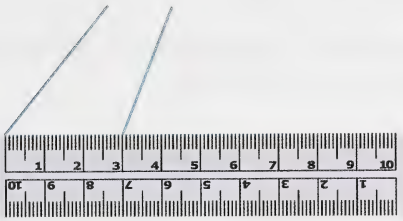
2. Take your ruler and extend the line on the left.



3. Extend the other line.

4. What happens to the lines? Can you make them intersect?

5. What did you have to do with your ruler to move to the second line?
6. Use your ruler to measure between the endpoints on the bottom. Record your measures on your paper.



7. Use your ruler to measure between the endpoints on the top. Record your measures on your paper.
8. Reflect: What do you notice about the two measurements? What does this tell you about these two line segments?
9. Trace the following line segments on your own paper.

10. Take your ruler and extend each line like you did in number 2.
11. What happens to the lines? Can you make them intersect?
12. What did you have to do with your ruler to move from one line to the other? How is this different from what you had to do with the other two lines?
13. Use your ruler to measure between the endpoints on the left. Record your measures on your paper.

14. Use your ruler to measure between the endpoints on the right. Record your measures on your paper.

15. Reflect: What do you notice about the two measurements? What does this tell you about these two lines?

16. Reflect: What are the properties of parallel lines? How are they different from intersecting lines?

Perpendicular

Lines and segments that are perpendicular form a right angle.

You can find perpendicular line segments in some polygons. Here are a few:

The following Exploration will allow you to cut out figures to find parallel segments. Save the cut-out figures for another Exploration.

Let's Explore

Exploration 2: Parallel, Intersecting and Perpendicular Segments in Polygons

Materials: Unit 3, Lesson 7, Exploration 2 page from your Workbook, Page of Polygons from the back of this Unit in your Workbook, Scissors, Ruler or straight edge, Pencil, Paper

Procedures:

1. Cut out all of the polygons.
2. Take one polygon and lay it on your paper.
3. Trace two sides of the polygon that you think are parallel.
4. Lift the pattern and see if your lines are parallel. You can use a ruler and your pencil to extend the lines to see if they will intersect.
5. Check to see if any other sides of the polygon are parallel in the same manner.
6. Record the number of side pairs that are parallel.
7. Check to see if any of the sides are perpendicular.
8. Record the number of pairs of sides that are perpendicular (this is the number of right angles in the figure).
9. Repeat for each polygon.
10. Reflect: Which polygons have parallel lines? Which polygons have perpendicular lines?
11. Reflect: How can you use this information to tell what type of polygon a 2-D figure is?

Vertical and Horizontal Lines

Vertical lines or line segments are represented as up and down on paper.

Horizontal lines or line segments are represented as moving left to right on paper.

One way to remember these terms is to compare them to things you know.

Let's try this using your own body!

Stand up. Imagine that a line runs the length of your body like this:

This represents a vertical line. You are vertical when you are standing.

Now put your arms straight out from your sides. Imagine that a line runs between your hands like this:

Your arms are parallel with the ground. This is horizontal.

You can also find examples of objects that are vertical or horizontal in the environment.

Vertical:

Tree

Building

Horizontal:

Horizon

Boat

Let's Practice

- Turn in your Workbook to Unit 3, Lesson 7 and complete 1 to 13.

Go online to complete the Concept Capsule about Properties of Triangles.

Lesson 8

Parallelograms

Folk Music

Zach's family loves to play in a folk music band. They have many types of instruments that they play. Zach found that in between some of his frets on this guitar, there are decorative **parallelograms.** The frets are the bars that the strings press against.

Reflection

Can you find examples of parallelograms in your environment?

Objectives for this Lesson

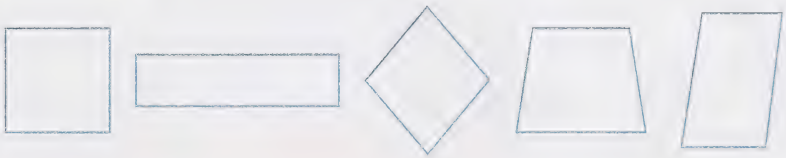
In this lesson you will explore the following concepts:

- Describe the attributes of a parallelogram
- Relate rectangle attributes to parallelogram attributes
- Given the measures of the sides find the perimeter

Go online to watch the Notepad Tutor about Classifying Polygons.

Sides of a Parallelogram

You should remember that a **quadrilateral** is a **polygon** with four sides. Here are some quadrilaterals:



As you can see by the figures here, quadrilateral can mean some very different things. In order to be more descriptive we can limit the name quadrilateral with other names.

A parallelogram is a quadrilateral. When you use the name parallelogram you have narrowed down the first set of quadrilaterals to the following:

Look at the sides of the parallelograms and make observations. There are two **attributes** of the sides of a parallelogram. Attributes are rules for defining the parallelogram.

The sides of a parallelogram have these attributes:

Opposite sides are parallel

Opposite sides are congruent

Be careful! In this figure there is one pair of opposite sides that are parallel:

Why isn't this figure a parallelogram?

The blue sides are parallel, but the other attribute is ignored. The opposite sides are not **congruent**.

Example 1

Which of these shapes have two pairs of opposite sides that are parallel?

The answer is:

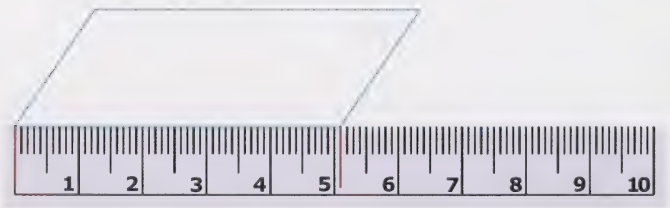
 and 

The other two have one pair of sides that are parallel but those sides are not congruent.

Example 2

Measure the sides of the parallelogram in centimetres. Are opposite sides congruent?

Use a centimetre ruler. Line up the 0 mark with one endpoint and measure to the other endpoint:



This side is 5.1 centimetres. Measure the opposite side. It also measures 5.1 centimetres. This pair of sides is congruent.

Now measure a short side:

This side is 2.2 centimetres. Measure the opposite side. It also measures 2.2 centimetres.

The answer is:

One pair of opposite sides measure 5.1 cm and are congruent.
The other pair of opposite sides measure 2.2 cm and are congruent.

Angles of a Parallelogram

The angles of a parallelogram follow the attribute:

Opposite Angles are Congruent

So what are opposite angles? In a quadrilateral there are two ways to describe a pair of angles. Pairs of angles are either **opposite angles** or **consecutive angles**.

Opposite angles are found opposite of one another inside the figure:

Consecutive angles are connected inside the figure:

Example 3

Use the numbers that mark the angles to complete the statements.

A. Angle 1 is opposite angle _____.
Angle 1 is opposite angle 3. This is the only answer for this statement.

B. Angle 1 and Angle _____ are consecutive angles.
Angle 1 and Angle 2 OR 4 are consecutive angles, depending on whether you go down or across from Angle 1. Either answer is correct.

C. Angle 2 is opposite angle _____.
Angle 2 is opposite angle 4. This is the only answer for this statement.

D. Name two angles that are consecutive angles to Angle 3.
Angle 2 and Angle 4 are consecutive angles to Angle 3.

Reflection

How can you tell if the angles are congruent?

Let's Explore

Exploration 1: Angle Attributes of Parallelograms

Materials: Unit 3, Lesson 8, Exploration 1 page from your Workbook, Scissors, Pencil, Page of parallelograms from the back of this Unit in your Workbook

1. Cut out the parallelograms on the page found at the back of this Unit in your Workbook.

2. Rip corners 2 and 4 off of Parallelogram A as shown:

3. Now overlap Angles 2 and 4 so that they match up – or not. Do the edges of the angles overlap? If so, they are congruent.

4. Repeat the test on Angles 1 and 3.

5. Repeat the test on Parallelograms B and C.

6. Are opposite angles always congruent?

7. Are there any other observations you can make about angles in a parallelogram?

Are These Parallelograms?

Here is a group of parallelograms:

All of the sides of the figures are marked with their measures. This should tell you that they all have opposite sides that are congruent. You should also be able to tell that they are parallel.

All of these figures are parallelograms, but three have special names.

There are special parallelograms that have more attributes:

Rectangle		ALL angles are right angles
Rhombus		All sides are congruent
Square		ALL angles are right angles All sides are congruent

These figures have the attributes of parallelograms. They also have these extra attributes that make them special.

Example 4

Nina and her father have made a garden in their backyard. She says that the garden is shaped like a parallelogram.

Cameron says that it is shaped like a rectangle. He shows Nina that the corners are all right angles by putting his clipboard in each one.

Who is right and why?

The garden has all the attributes of a parallelogram:

- opposite sides are parallel
- opposite sides are congruent
- opposite angles are congruent

This means that Nina is right! It is a parallelogram.

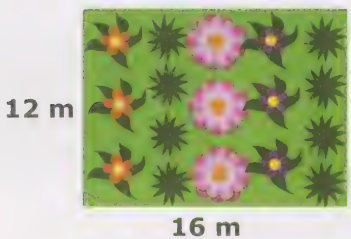
The angles in the corners are all right angles. This means that Cameron is right! It is also a rectangle.

How often are two friends right when they disagree? This may be a first!

- Turn in your Workbook to Unit 3, Lesson 8 and complete 1 to 12.

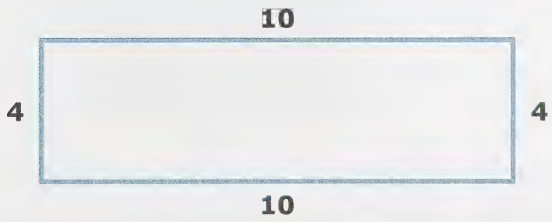
Perimeter

Nina wants to put a fence around her garden. She will need to know how much fence material to buy. She measures two sides of her garden:



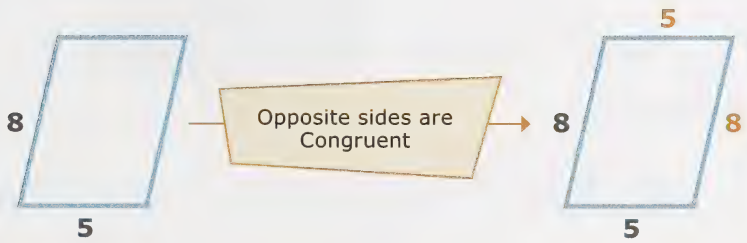
Can Nina find the perimeter of her garden with only these two measurements?

The perimeter of parallelograms is found by finding the distance around. You probably remember that this is done by simply adding up the sides.



Perimeter = 4 + 10 + 4 +10 = 28

If you know that the figure is a parallelogram then you know that the opposite sides are congruent. You can use that attribute to find the missing sides.

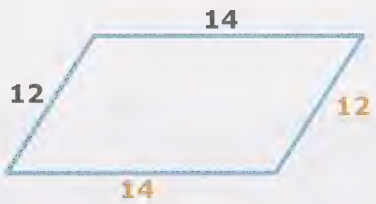


Now let's try one.

Example 5

Find the perimeter of the parallelogram.

Find the missing sides using the attribute "opposite sides are congruent." In this case that means that they are the same measure:



Add up all of the side lengths to get the perimeter: 12 + 14 + 12 + 14 = 52

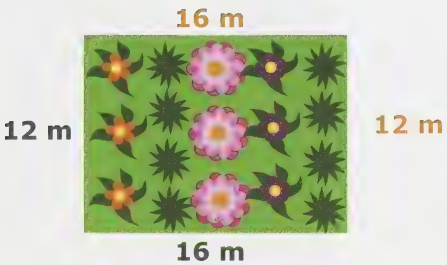
The perimeter is: 52

Using the same method you can find the perimeter of Nina's garden.

Example 6

Find the perimeter of Nina's garden.

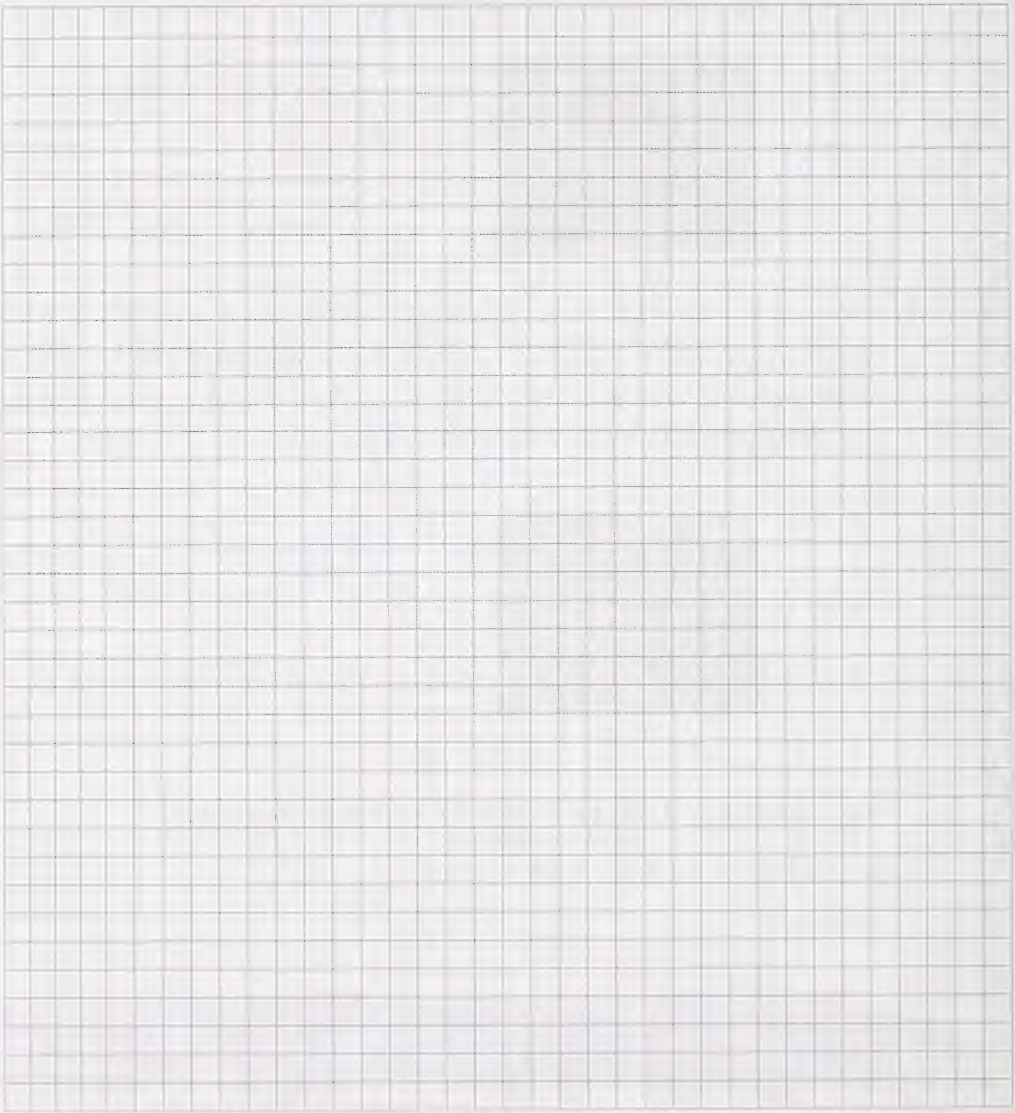
Nina was so smart when she took the measurements! She measured one short side and one long side. She can use the attribute "opposite sides are congruent" to find the missing sides:



Now she can find the perimeter by adding all four sides:

12 + 16 + 12 + 16 = 56 metres

- Turn in your Workbook to Unit 3, Lesson 8 and complete 13 to 18.



Lesson 9

Trapezoids

Tile Patterns

Daksha decided to create a tile top for his table. He has two different shapes of tiles that he can use to create the pattern. The triangles are grey and the squares are blue.

He finds that he can combine two triangles and a square in a few ways:

These shapes are all quadrilaterals and they all have special names. Can Daksha make a tile pattern with these shapes that will cover a rectangle?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Describe properties of trapezoids
- Use trapezoids, parallelograms and triangles to build figures

Trapezoids

A **trapezoid** is a quadrilateral that has one pair of parallel sides.

The parallel sides are highlighted orange in this picture.

You might notice that they are not congruent. Parallelograms have opposite sides parallel and congruent. This is not true for trapezoids.

The pair of opposite sides that are parallel in a trapezoid cannot be congruent. The other pair of sides may be congruent or they may be different:

Reflection

Why can't the sides that are parallel be congruent in a trapezoid?

The following exploration will let you work with the properties of a trapezoid.

Let's Explore

Exploration 1: Can I Make a Trapezoid?

Materials: Unit 3, Lesson 9, Exploration 1 page from your Workbook, Spaghetti noodles (uncooked), Paper, Pencil

Procedures:

1. Take two spaghetti noodles and make sure they are congruent (the same size and shape). These noodles become your given side lengths.
2. Put these noodles on your blank paper so that they are parallel.
3. Use your pencil to connect the endpoints to form a quadrilateral. This means you will make two segments to connect these that do not cross.

4. What is the name of your quadrilateral?

5. Is it possible for you to make a trapezoid if these two sides are congruent and parallel? Describe why it is or is not possible to make a trapezoid with these parallel and congruent sides.

   Hint: shift them around to see if you can create a trapezoid—but they have to be parallel.

6. Now take your noodles and make them consecutive. This means to put the endpoint of one to the endpoint of the other.

7. Now is it possible to create a trapezoid? You may need to use your straight edge to make sure the two new segments are straight.

8. Describe the figure you created in number 7 and explain why it is or is not a trapezoid.

Example 1

Which of the following is a trapezoid?

A. 

This is a trapezoid. One pair of opposite sides is parallel.

B. 

This is not a trapezoid. All sides are congruent and opposite sides are parallel so it is a rhombus.

C. 

This is a trapezoid. One pair of opposite sides is parallel.

D. 

This is not a trapezoid. No sides are parallel or congruent.

It is a quadrilateral.

Go online to watch the Notepad Tutor about Parallel, Intersecting, Perpendicular, Vertical, and Horizontal Sides.

Building Figures

What about Daksha's tile pattern? Can you create a pattern that will cover his tabletop?

Use the following Exploration to build a rectangular tabletop out of the given tiles.

Exploration 2: Tabletop Pattern

Materials: Unit 3, Lesson 8, Exploration 2 page from your Workbook, Scissors, Paper, Glue, Crayons, Page of shapes from the back of this Unit in your Workbook, Centimetre grid paper from the back of this Unit in your Workbook

1. Cut out all of the shapes on the page of shapes from the back of this Unit in your Workbook.
2. Can you create a trapezoid using a square tile and a triangle? Sketch it below if you can.
3. Can you create a trapezoid using a square tile and two triangles? Sketch it below if you can.
4. Use your tiles to create a tabletop pattern. The table you are covering is in the shape of a rectangle. You should have no gaps or holes in your pattern.
5. Glue the shapes to your paper.
6. Use centimetre grid paper and crayons to show your pattern.
7. What quadrilateral shapes can you identify in your pattern? List them all.

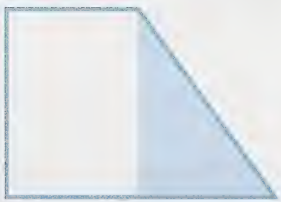
Example 2

What shapes form this trapezoid?

Think of the shapes that you have studied so far. What simple shapes can you combine to make this trapezoid?

If you think of a rectangle and how it fits, the left side can be a rectangle:

This leaves a triangle on the right.

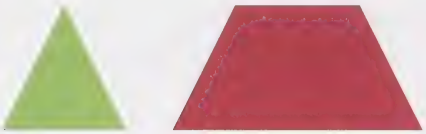


The answer is: This trapezoid is formed by a rectangle and a triangle.

Let's Explore! For Example 3 and for the matching exercises in your Workbook you will need: Pattern Blocks (Found at the back of this Unit in your Workbook), Scissors, Paper

Example 3

From your pattern blocks select the following shapes. You can use more than one pattern block for this.



How can you create the trapezoid using only triangle blocks?

Take triangle blocks and shift them around until you have the shape of a trapezoid.

You should be able to come up with:

The answer is: Three triangles make the trapezoid.

- Turn in your Workbook to Unit 3, Lesson 9 and complete 1 to 11.

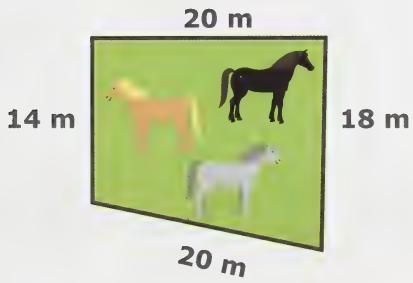
Lesson 10

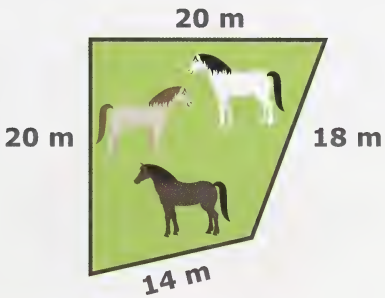
Classifying Quadrilaterals

A Corral for the Horses

Cameron and Alyssa are visiting a ranch and are helping to make a new corral for the horses. They have four pieces of fencing to use on the corral. One piece is 14 metres long, one is 18 metres long and two pieces are 20 metres long.

If they use the pieces without cutting them down the corral may look like this:





Alyssa is not happy. She wants the corral to be built in the shape of a rectangle. She has asked Cameron to make the corral into a rectangle.

Reflection

Can Cameron make a rectangle out of these pieces? What is the largest rectangle he can make using these pieces?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Sort quadrilaterals according to their attributes
- Identify and describe the characteristics of a pre-sorted set of quadrilaterals
- Explain a sorting rule

Classifying Quadrilaterals

A quadrilateral has 4 sides. Let's review the attributes of some quadrilaterals, and review their special names.

Parallelogram

- Opposite sides parallel
- Opposite sides congruent
- Opposite angles congruent

Rhombus

- Opposite sides parallel
- All sides congruent
- Opposite angles congruent

Trapezoid

- One pair of opposite sides parallel

Rectangle

- Opposite sides parallel
- Opposite sides congruent
- Opposite angles congruent
- 4 right angles

Square

- Opposite sides parallel
- All sides congruent
- Opposite angles congruent
- 4 right angles

Example 1

Is the figure a quadrilateral?

If it has a special name, what is it?

A.

This is a quadrilateral. Since it has no attributes matching a special quadrilateral it doesn't have a special name.

B.

This is a quadrilateral. It has one pair of parallel sides, so it is a trapezoid.

C.

This is a quadrilateral. It has four right angles and the opposite sides are congruent and parallel. It is a rectangle.

Example 2

Lian drew a quadrilateral. It has four right angles. What is the name of the quadrilateral?

This is a tough one! You can start by creating a sketch of a quadrilateral with four right angles. You could draw either of these:

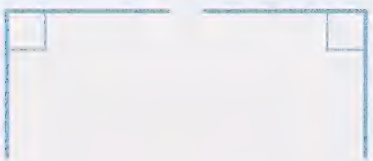
You have drawn a rectangle or a square. The answer is: rectangle or square.

Example 3

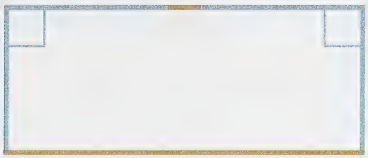
Can you draw a quadrilateral with two right angles? Does the quadrilateral have a special name?

There are several answers to this problem. Use a sheet of paper and a pencil to see what you can get.

If you start with two right angles like this:



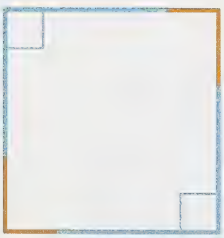
You might come up with one of these:



You would have come up with a rectangle or a trapezoid.

If you start with two right angles like this:

You can only come up with something like this:



This is a rectangle or a square. It depends on how far apart you start the angles.

Let's Practice

Go online to complete the Concept Capsule about Classifying Quadrilaterals.

- Turn in your Workbook to Unit 3, Lesson 10 and complete 1 to 14.

Venn Diagrams

You can use a Venn diagram to sort shapes.

For the next example and for the matching questions in your Workbook you will need the following:

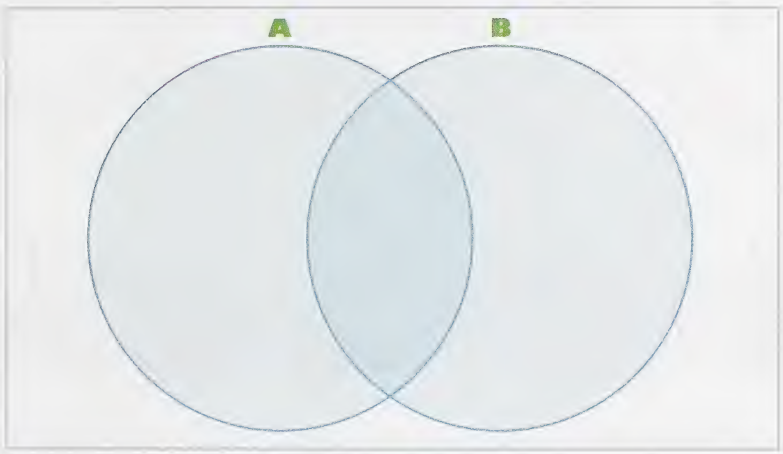
- Quadrilateral cut-outs and Venn Diagram Mat (both from the back of this Unit in your Workbook)
- Scissors
- Pencil

Example 4

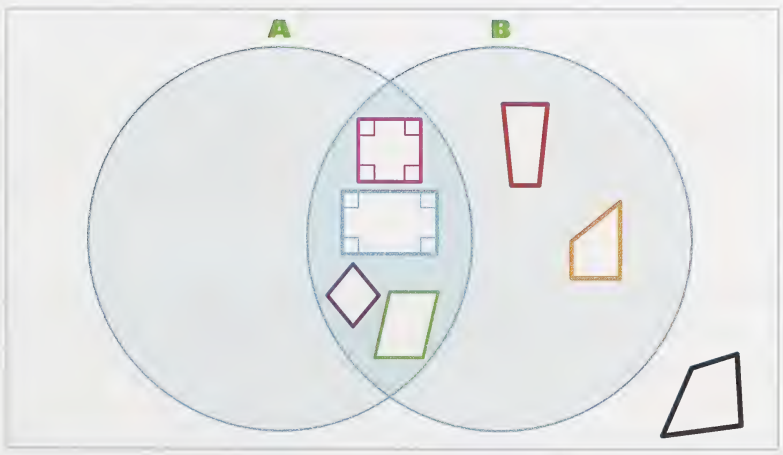
Sort the shapes by the given rules:

A = opposite sides are congruent

B = at least one pair of opposite sides are parallel

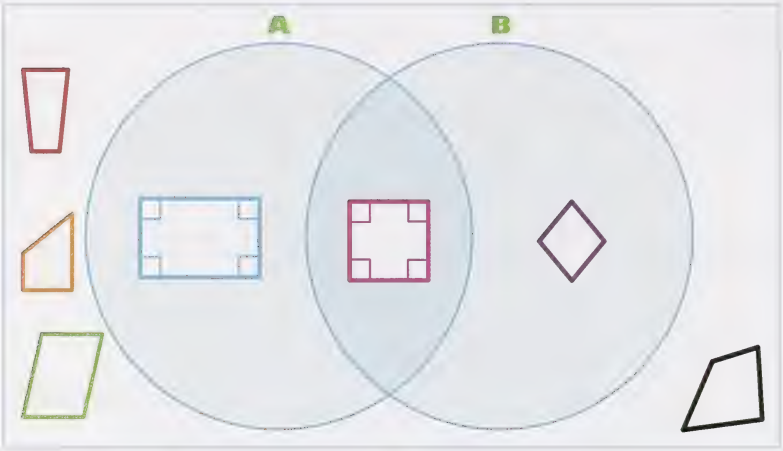


The answer is:



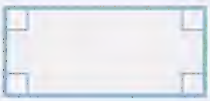
Example 5

What are the rules for the Venn diagram shown?



Circle A has a rectangle and a square. Think of the attributes of each:

Rectangle



- Opposite sides parallel
- Opposite sides congruent
- Opposite angles congruent
- 4 right angles

Square

- Opposite sides parallel
- All sides congruent
- Opposite angles congruent
- 4 right angles

These figures have a lot in common. The four right angles create all the other attributes in the figures. You should be able to narrow this down to four right angles.

The figures of circle B are a rhombus and a square.

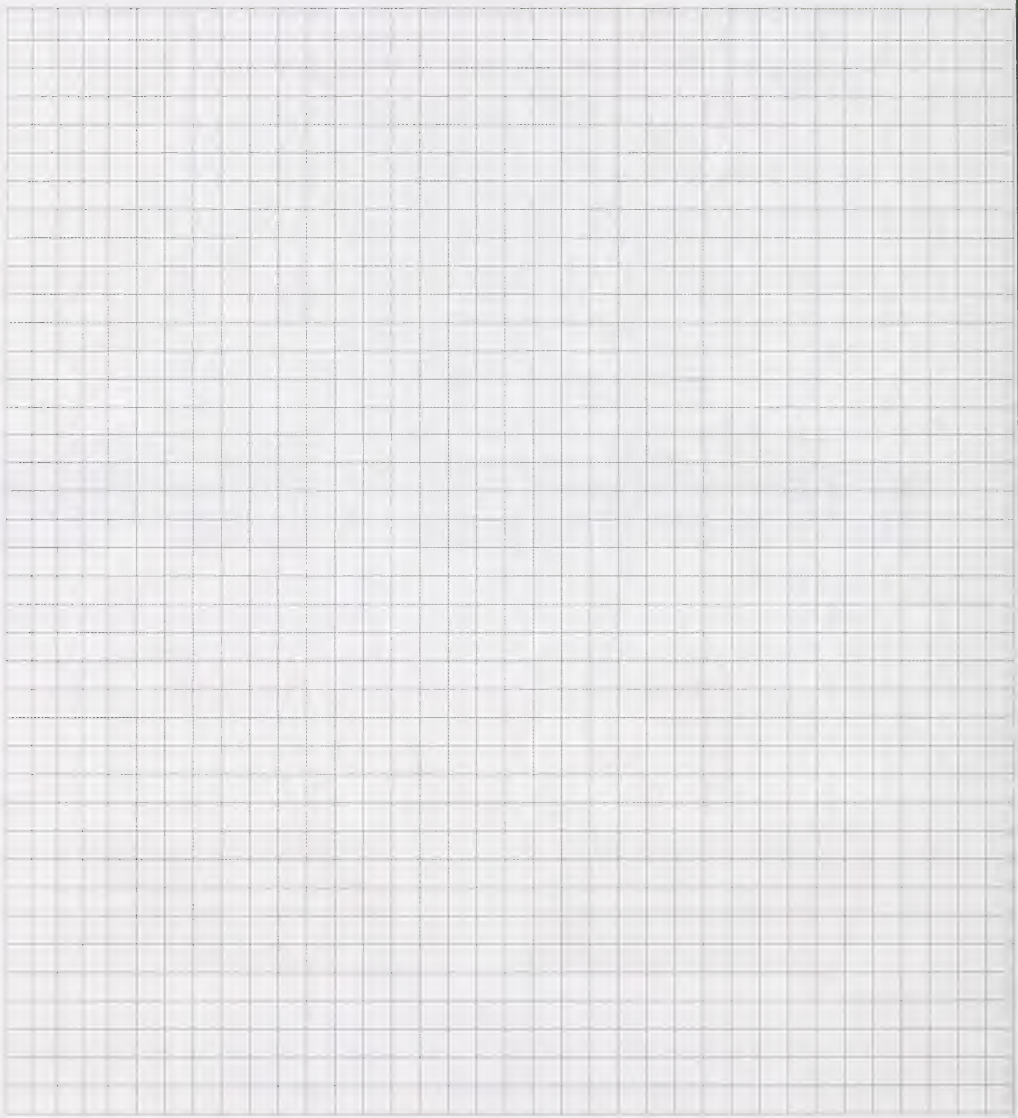
These figures have the attribute "all sides congruent" in common.

The square in the middle has both of these attributes:

- 4 right angles
- all sides congruent

The answer is: A = 4 right angles B = all sides congruent

- Turn in your workbook to Unit 3, Lesson 10 and complete 15 to 18.



Lesson 11

3-D Objects

Playing Board Games

Zach has a new board game that he wants to play with his friends. He notices that the box the game is stored in is a lot like the prism he learned about in his math lesson. It has faces, edges, vertices and bases.

The bases are **parallel**.

The side of the box is a face and it is **perpendicular** to the bottom of the box or a base.

The edges of the box top are perpendicular and parallel.

Perpendicular

Parallel

Reflection

What does the term perpendicular mean?
How would you explain it to a young child?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Identify and describe parallel, intersecting, and perpendicular edges and faces
- Identify and describe vertical and horizontal edges and faces
- Identify 3-D objects in the environment

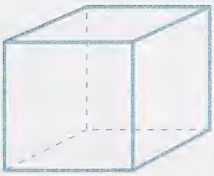
Go online to watch the Notepad Tutor about Sorting Right Rectangular Prisms and Right Triangular Prisms. Also watch the Notepad Tutor about Constructing Prisms.

Prisms and Pyramids

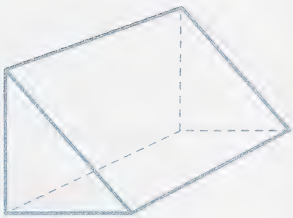
Solid figures are 3-dimensional. They take up space that has length, width, and height.

A **prism** is a solid figure. It has two parallel congruent **bases** that are connected by other **faces**. The other faces are all rectangles.
The shape of the bases determines the name. Here are some prisms you should know:

Rectangular Prism

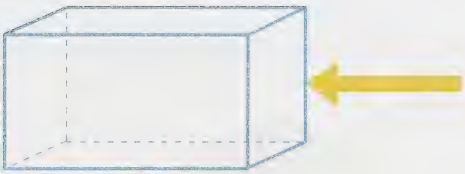


Cube

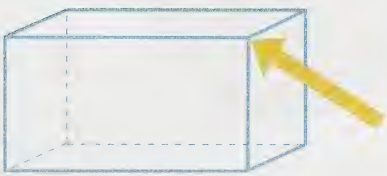


Triangular Prism

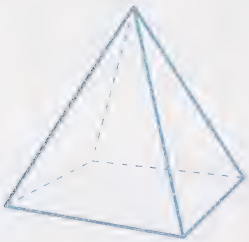
The line segment where two faces connect is called an **edge**.



A **vertex** is a point where three or more faces connect.

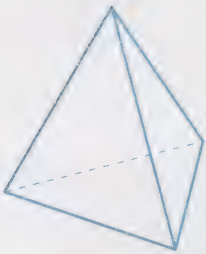


A **pyramid** is a solid figure. Pyramids have one base, and all other faces that are triangles. The faces all share a vertex. The name of the pyramid is determined by the shape of the base. All faces except the base share one vertex.



Square Pyramid

Pentagonal Pyramid



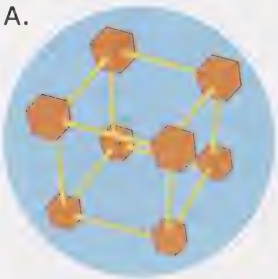
Triangular Pyramid

Do you need a way to keep these straight? You may notice that the prisms have "flat tops" and the pyramids have "pointy tops". This will help you remember the difference between the two.

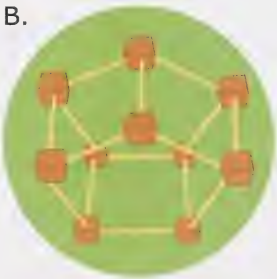
Example 1

Nina is building a prism out of cheese cubes and toothpicks. Which of the following is NOT Nina's construction?

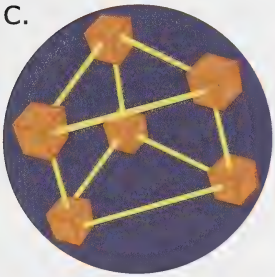
A.



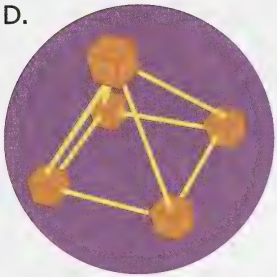
B.



C.



D.



The answer is D. D is a triangular pyramid and has a "pointy top." The rest are prisms since they have two bases that are congruent and parallel to each other.

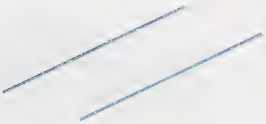
Parallel, Intersecting and Perpendicular Parts

You can use the following words to describe the faces and edges of solid figures:

parallel intersecting perpendicular

Parallel means the figures will never touch if you extend them in all directions.

Parallel Lines



Parallel Faces

Perpendicular means the figures will form a right angle.

Perpendicular Lines

Perpendicular Faces

For Example 2 you will need:

- A cereal box
- A pencil

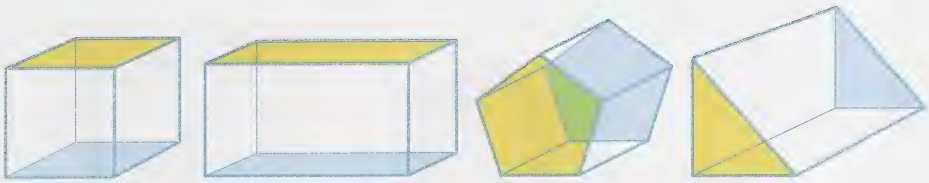
Example 2

Put the cereal box on your table or desktop. The bottom of the box is the base of your prism.

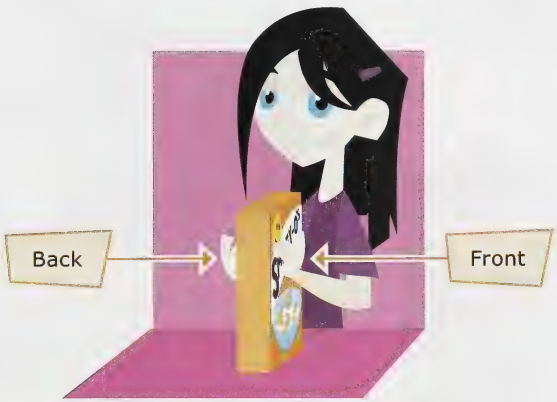
Put your hand on the part of the box that is parallel to this base. If you have your hand on the top of the box, you are right!

These are both called the bases. Are these bases parallel? If you said yes, then you are right!

The bases of all prisms are parallel.



Now touch the front of the box with one hand and the back of the box with your other hand.



These faces are also parallel.

Now touch two faces, or a base and a face that are perpendicular. There are many. As long as your pair meets at a common edge, they are perpendicular.

When a pair of faces meets at a common edge, they are intersecting. When a pair of faces forms a right angle, they are perpendicular. The top and front of the box are also intersecting.

Now look at the edges of the box. Point to the edge where the front of the box and the top meet.

Now point to the edge where the back of the box and the top meet.

These edges are line segments and they are parallel.

Point to the edge where the front of the box and the side meet.

What edge is parallel to this edge? Here is one:

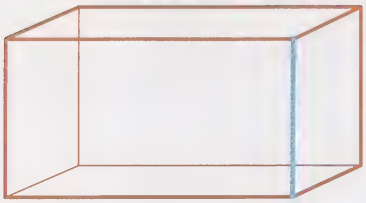
What edge is perpendicular to this edge? Here is one:

You should be able to tell that the point where the edges intersect is the vertex. There are three edges that intersect at each vertex in a rectangular prism.

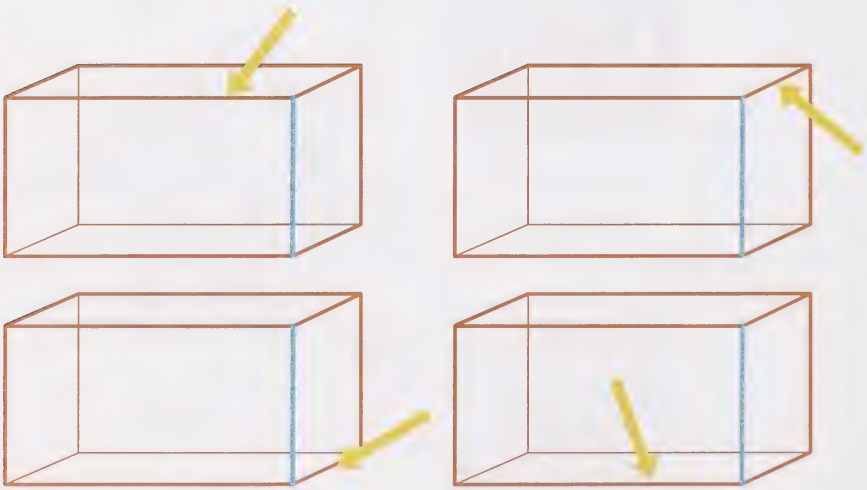
You are now ready to identify parallel and perpendicular parts of prisms and pyramids.

Example 3

Draw an arrow that points to an edge that is perpendicular to the blue edge in this figure.



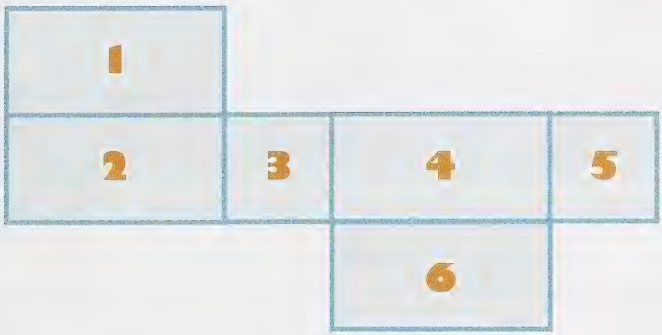
There are four edges that are perpendicular to the blue edge:



They may not look perpendicular in the figure, but you have to remember that the faces are all rectangles.

Example 4

This is a net of a square based prism. When you fold it up it forms the prism. Which face will be parallel to Face 4 when the prism is formed?



The answer is Face 2. Faces 6 and 1 will be perpendicular to Face 4. The bases are the squares 3 and 5. They will also be perpendicular to Face 4.

- Turn in your Workbook to Unit 3, Lesson 11 and complete 1 to 14.

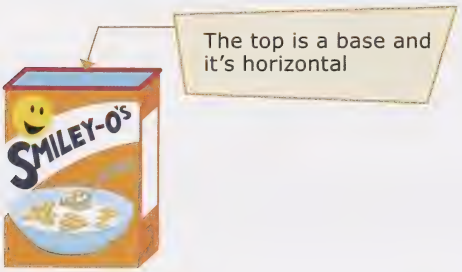
Vertical and Horizontal

You can use your cereal box prism to identify parts by the terms:

- vertical
- horizontal

Edges and faces that are vertical are also perpendicular to the base:

Edges and faces that are horizontal are parallel to the base:



You can identify parts of a prism or pyramid as vertical or horizontal.

Example 5

Cameron is on the phone with Daksha. He tells Daksha that the ceiling in his room is horizontal because his room is shaped like a rectangular prism and the floor is a base. Daksha says that the ceiling is parallel to the floor. Who is right and why?

Cameron's ceiling is a base of the prism. It is horizontal to the ground, or in this case the floor. So he is right.

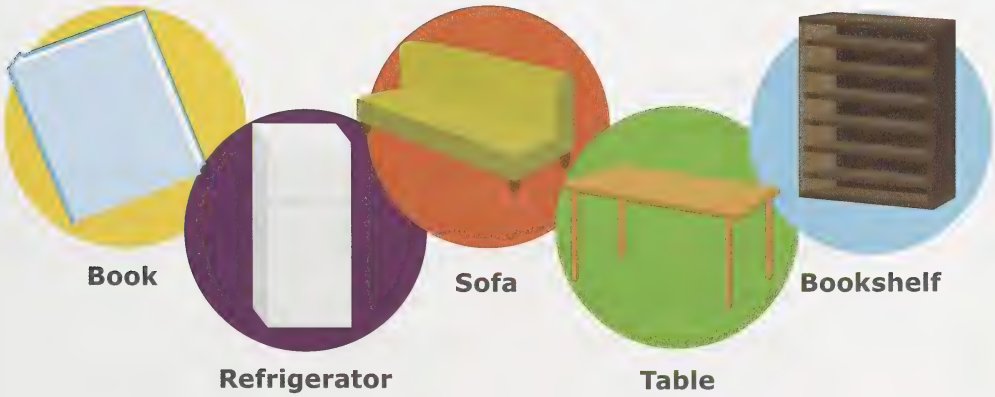
In a prism the bases are always parallel. Since Daksha is comparing two bases he is also right.

Reflection

How many pairs of faces in a rectangular prism are "congruent and parallel?"
How many pairs of bases are possible?

Objects in Your Environment

There are many prisms and pyramids in your environment.
Do you recognize any of these prisms?



You may have objects in your home that include a combination of solid shapes. This artwork has many prisms and pyramids:

Objects in Life

You can use the Internet or magazines to find prisms and pyramids in your environment. Using these examples you can describe and identify faces and edges that are:

- Parallel
- Perpendicular
- Intersecting

Example 6

Find an object in your community that has the shape of a square prism.

a. Describe two edges that are parallel.

b. Describe two faces that are perpendicular.

Here is an example solution for the community of Calgary:

Object: The roofs of these condominiums in Calgary are square pyramids. Each building is a square prism.

a. The edge on the front left side of the first building is parallel to the edge on the far right side of the first building.

b. The front face and the side face are perpendicular faces.

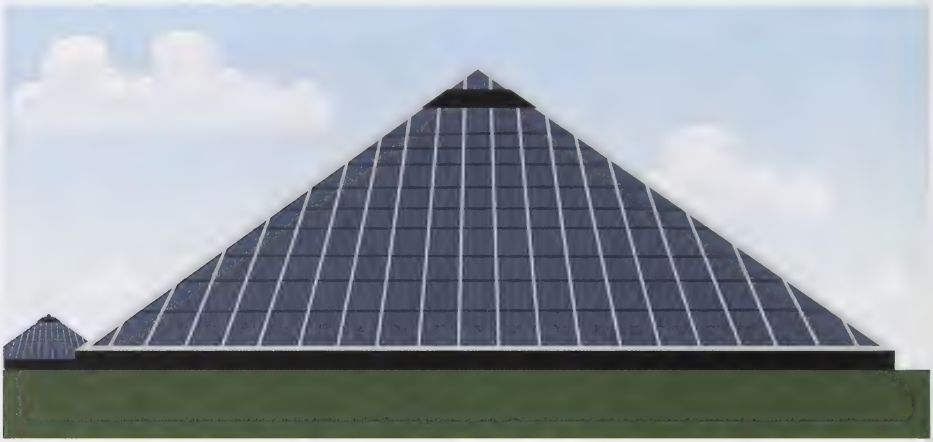
Example 7

Find an example of a square pyramid in your community.

a. Describe two faces that are intersecting.

b. Describe two edges that are parallel.

Here is an example solution for the community of Edmonton:



Object: The Muttart Conservatory boasts a pyramid shaped greenhouse in Edmonton.

a. Any two faces in the figure are intersecting. All faces and the base of a pyramid intersect.

b. There are two pairs of edges that are parallel on this pyramid. One is on the front of this building and connects the face to the base. It is parallel to the edge that connects the back of the building to the base.

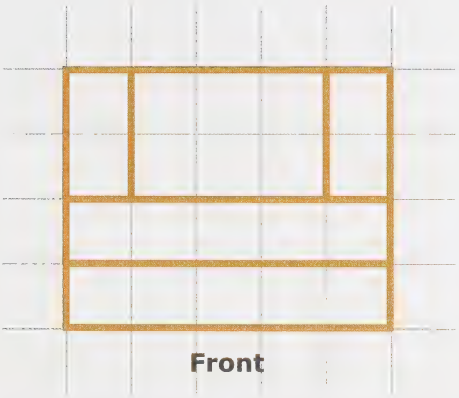
- Turn in your Workbook to Unit 3, Lesson 11 and complete 15 to 31.

Lesson 12

Drawing 3-D Objects

Home Interior Plans

Lian is helping to decorate her new home. Her family wants a new entertainment center for the TV and she decides to design it herself. Lian will design it and send her design to a carpenter who will build it. Lian decides to use a point method she learned in art class to draw her entertainment center. Can you tell what her entertainment center should look like from the drawing?



Objectives for this Lesson

In this lesson you will explore the following concept:

- Draw 3-D objects that have edges and faces that are parallel, intersecting, perpendicular, vertical, or horizontal.

Drawing 3-D Object

You can draw a solid figure on paper. There are two easy methods.

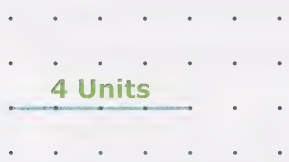
For the next few examples you will need: Dot paper from the back of your workbook, Pencil, Eraser, Straight edge (or ruler)

One method for drawing 3-D objects uses dot paper.

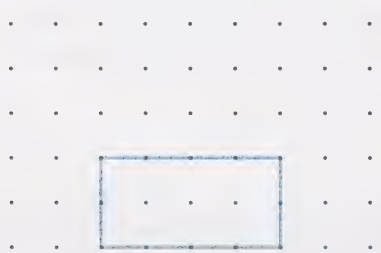
Example 1

Draw a rectangular prism on dot paper that has a base of 4 units long by 2 units high.

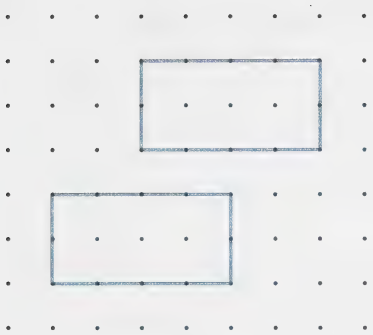
On your dot paper, one unit is the distance between two dots from left to right, or up and down.



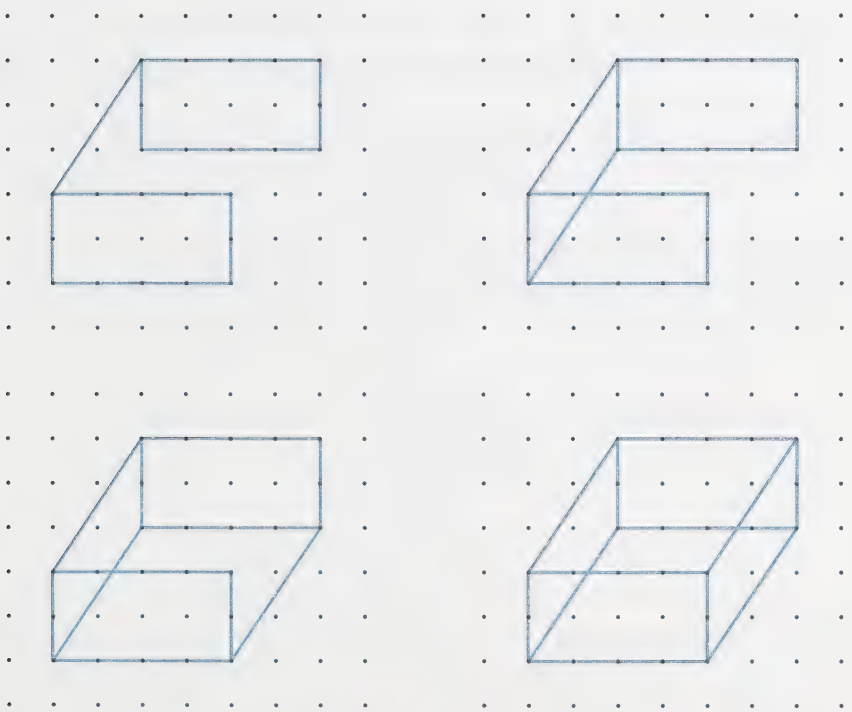
1. Draw your base:



2. Repeat your base above and to the right of the original:



3. Connect the corresponding corners of the bases one at a time:

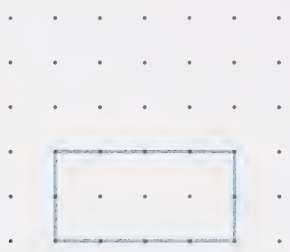


The last connection made your prism!

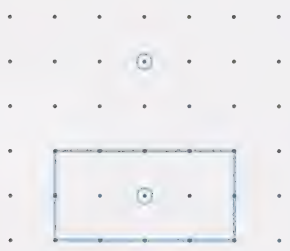
Example 2

Create a pyramid with a base that is 2 units by 4 units.

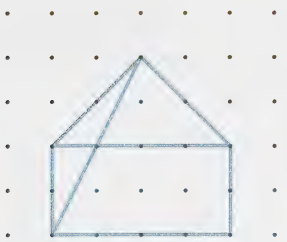
1. Draw your rectangular base:

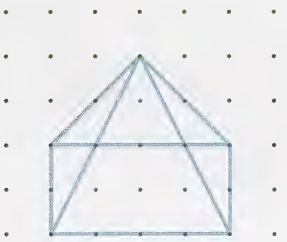


2. Find the dot in the middle of your rectangle (circled below). Circle the dot directly above this dot, at least two dots up from your rectangle.



3. From the dot you chose above your rectangle, draw a line to each of the corners of the rectangle base.





The last figure shows your completed pyramid!

Another method you can use does not require dot paper. It is called point perspective and is used in art.

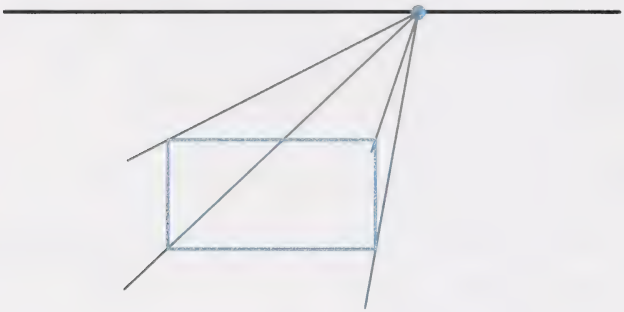
Example 3

Draw a rectangular prism using point perspective.

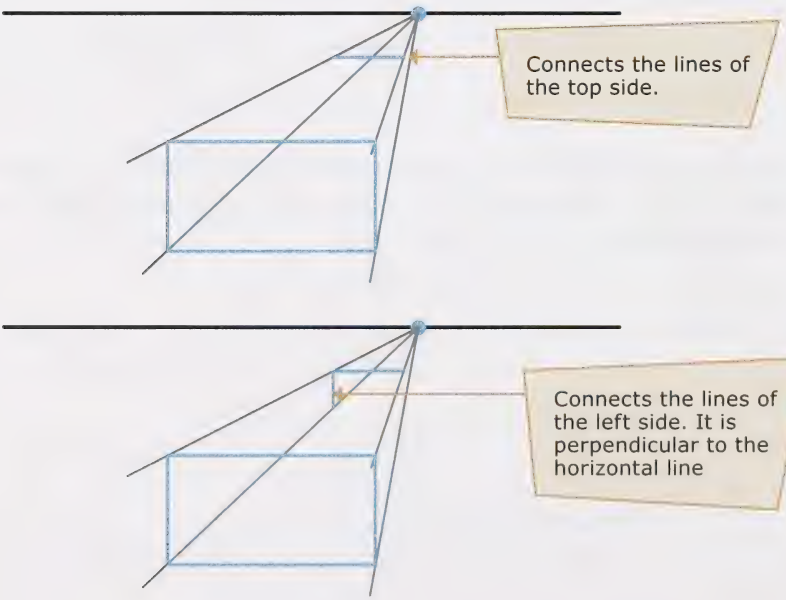
1. Draw a horizontal line on your paper. Place a point on the line.

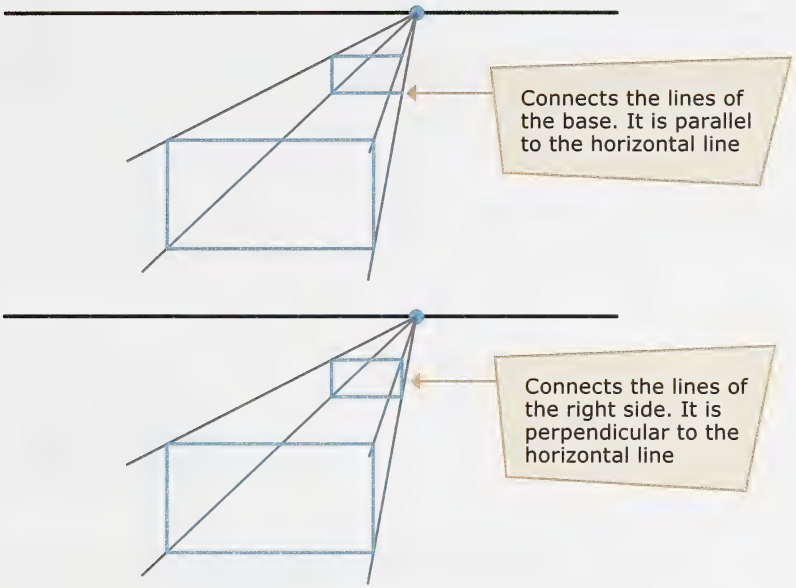
2. Draw a rectangle below your horizontal line. Position it so that two of the sides are parallel to the horizontal line. The other two sides will be perpendicular to the horizontal line.

3. Use your pencil and draw lines from the point through each corner of your box. Make your lines very light so you can erase them after you are done using them.

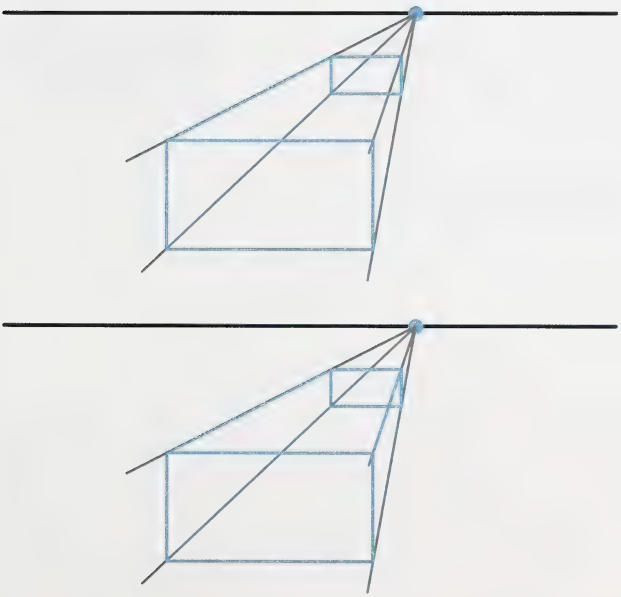


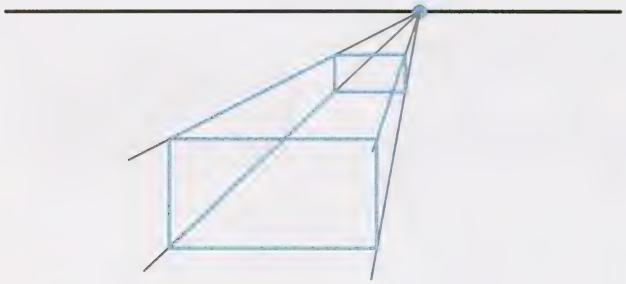
4. Draw a rectangle that has two sides parallel to the horizontal line and endpoints on the four lines:

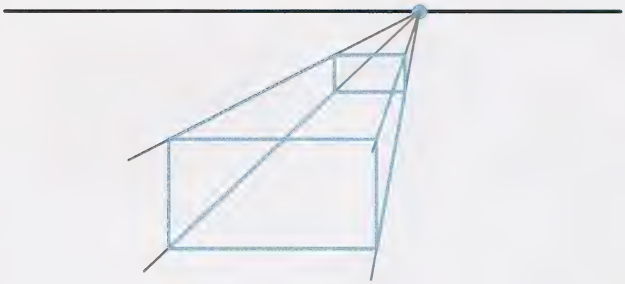




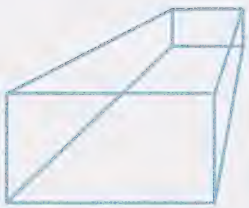
5. Connect the corners of the rectangles with darker lines:







6. Now erase the guide lines that you used and you will have a prism:



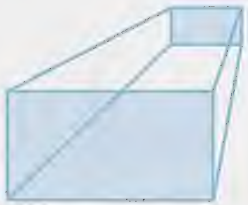
Parallel Edges and Faces

When you draw figures in 3-D it can be hard to identify parts as parallel.

Example 4

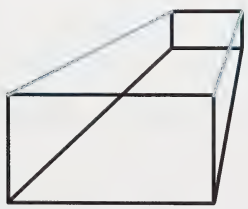
On the figure you created in Example 3, shade the first rectangle you drew. Shade the face that is parallel to this face.

The second rectangle that you drew is parallel to the face.



When you draw a figure in perspective, the parts look a little different. Some edges that are parallel do not look like they are. Some edges that are perpendicular do not look that way.

The blue edges are parallel:



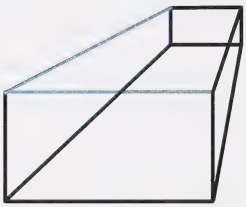
Let's Practice

- Turn in your Workbook to Unit 3, Lesson 12 and complete 1 to 6.

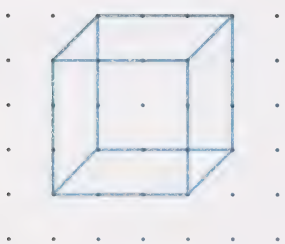
Intersecting and Perpendicular Edges and Faces

It is usually easy to tell that two edges or faces are intersecting. Some edges that are perpendicular do not look that way. These are harder to identify.

The blue edges are perpendicular:



Even your figures on dot paper can look a little strange:



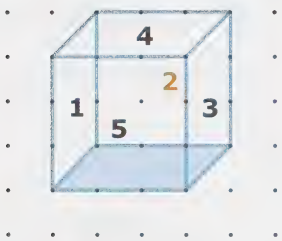
The edges that are parallel do look parallel. But they don't always look perpendicular.

Normally, you could put the corner of a piece of paper in the angle to see if it is a right angle.

The edges of the rectangular prisms drawn in this lesson would not pass that test. You should know that they are perpendicular because they are edges of the same face. All faces are rectangles.

Example 5

Name all faces that are perpendicular to the shaded base.



Face 2 is the back of the prism and Face 5 is the front.

The only face that is NOT perpendicular to the base is Face 4.

The answer is: 1, 2, 3, and 5

Example 6

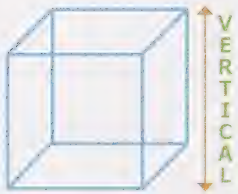
Multiple Choice: In this figure the blue edges are...

A. intersecting B. parallel C. vertical D. horizontal

The blue edges intersect at the vertex. The answer is: A

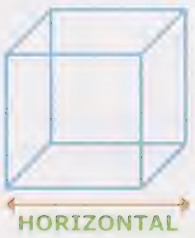
Vertical and Horizontal Edges and Faces

A face or an edge is vertical if it is perpendicular to the ground or appears to be up and down on the paper:



Any edge or face that is parallel to this vertical line is also vertical.

A face or an edge that is horizontal is parallel to the ground or runs left to right on the paper.



Any edge or face that is parallel to this horizontal line is also horizontal.

Remember, when you have drawn images on paper they may not LOOK horizontal or vertical. The attributes of the figure should help you decide.

Example 7

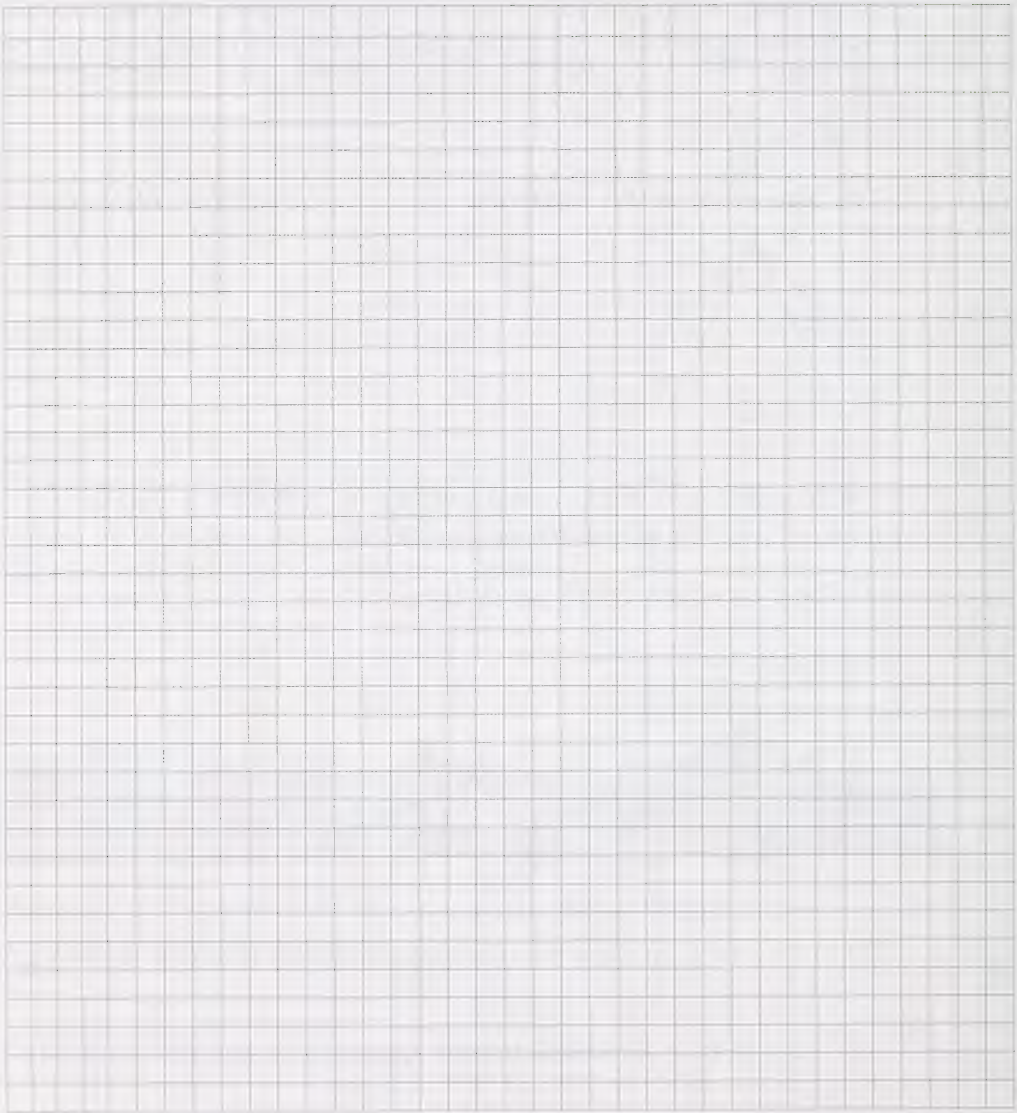
The blue edges in this figure are _____. (vertical or horizontal)

The blue edges in this pyramid are all part of the base. The base is horizontal so the edges are also horizontal.

The blue edges in this figure are horizontal.

Go online to complete the Concept Capsule about Drawing in 3-D.

- Turn in your Workbook to Unit 3, Lesson 12 and complete 7 to 13.

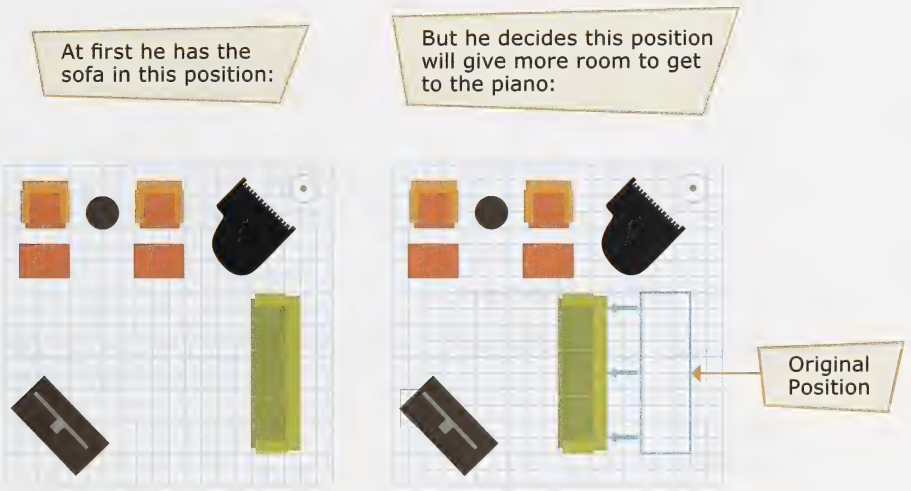


Lesson 13

Translations

Arranging Furniture

Zach is helping to decorate his living room. He uses grid paper and cut-out models of their furniture to help him decide on furniture placement.



To make this arrangement he had to slide the sofa cut-out across the grid paper. The cut-out did not change shape or size. Zach decides that he needs to slide the sofa 3 metres to the left.

Reflection

How does the grid paper help Zach to decide that the sofa has moved 3 metres?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Identify a translation
- Describe a translation using direction and distance
- Perform the translation of a 2-D shape by drawing its image

Identify a Translation

A **translation** slides a figure in one direction for a given distance.

You could simply slide the figure across the surface of your desk to make a translation. A translation does not change the size or shape of the figure. There are two pictures in a translation problem, the original and the image. The **image** is the new position of the original figure.

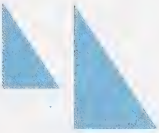
Example 1

Multiple choice: Which of the following is a translation?

A. 

B. 

C. 

D. 

Which one simply slides the figure in one direction without changing the size or shape?

The answer is: B

A, C and D are not the answers because:

A. The image turns
C. The image is flipped over a line
D. The image is larger

Go online to watch the Notepad Tutor about Corresponding Parts of Congruent Shapes.

Describe a Translation

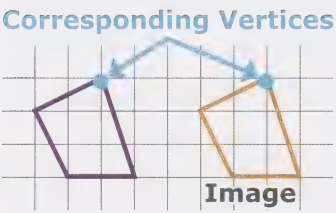
A translation can be described by the distance and direction that the figure is moved. You can use grid paper to help you describe this movement.

Example 2

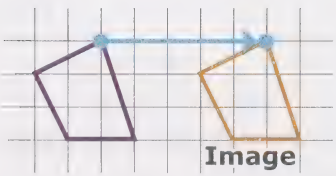
Describe the distance and direction for the translation shown.

The image is **congruent** to the original shape. You should remember that congruent shapes have corresponding parts.

1. Find a pair of corresponding vertices for the original shape and for the image:



2. Now draw an arrow between these, starting at the original:



3. Use the arrow to describe the translation:

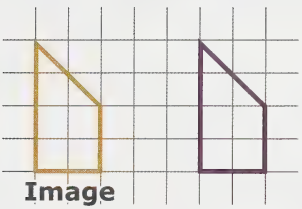
The arrow moves to the right so that is your direction. The arrow is 5 units long so that is your distance.

The answer is: 5 units right

Now It's Your Turn

Describe the distance and direction for the translations shown.

a.



b.

Solutions

a. 5 units left

b. 4 units down

- Turn in your Workbook to Unit 3, Lesson 13 and complete 1 to 4.

Translations can also involve moving figures in a diagonal direction. To describe a move like this you will need two directions.

Use the following exploration to understand how translations move the parts of a figure.

Let's Explore

Exploration 1: Translating Objects

Materials: Unit 3, Lesson 13, Exploration 1 page from your Workbook, Cut-out shapes from the back of this Unit in your Workbook, Pencil, Scissors, 3 sheets of Centimetre Grid paper from the back of this Unit in your Workbook

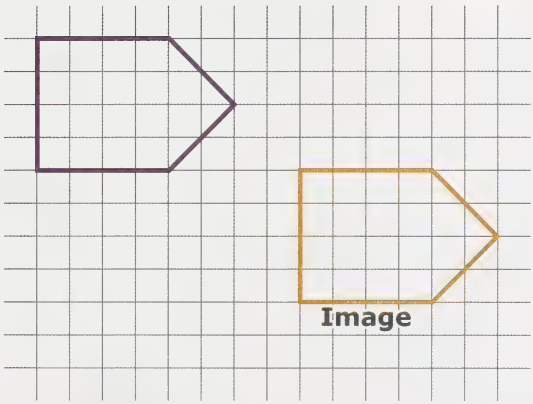
1. Cut out the shapes from the back of this Unit in your Workbook.
2. Take Shape 1 and place it on the grid paper so that all of the vertices line up with grid lines that cross.
3. Trace Shape 1 onto your grid paper. You will want to place it near the bottom of the page.
4. Now move Shape 1: 4 units up
5. Trace Shape 1 again. Write "Image 1" beside the image.
6. Now move Shape 1: 5 units right
7. Trace Shape 1 again. Write "Image 2" beside the image.
8. How would you describe the translation of the original position of Shape 1 to Image 1?
9. How would you describe the translation of Image 1 to Image 2?
10. How would you describe the translation of the original position of Shape 1 to Image 2?
11. Place Shape 2 on the grid paper and trace its outline.
12. Have a friend move the shape to a new position. Describe the translation of the original position of Shape 2 to the image.

13. Repeat instructions 11 and 12 with Shape 3.

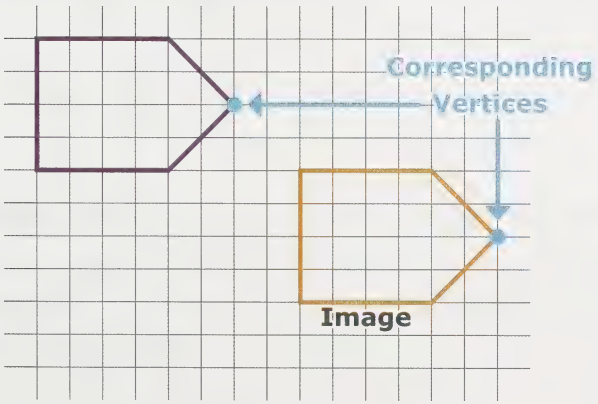
14. Trade with your friend. Move Shape 4 from an original position to an image position. Let your friend describe the translation.

Example 3

Describe the distance and direction for the translation shown.



1. Select a pair of corresponding vertices:

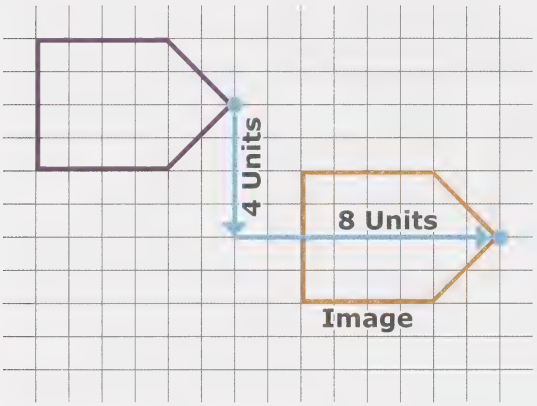


2. Find the directions. You need TWO straight paths between the points. There are two questions you need to answer:

Is the translation up or down? down

Is the translation left or right? right

3. Find the distances. Draw an arrow down and another right for the path that will take you to the image point:



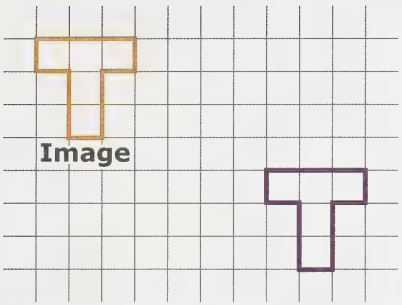
4. Put your direction and distance together to describe the translation:

The answer is: 4 units down and 8 units right

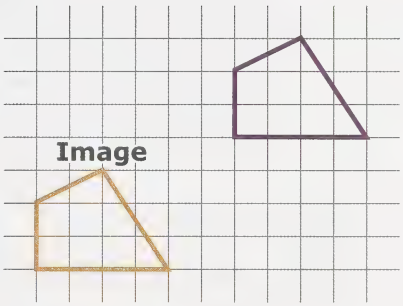
Now It's Your Turn

Describe the distance and direction for the translations shown.

a.



b.



Solutions

a. 4 units up and 7 units left

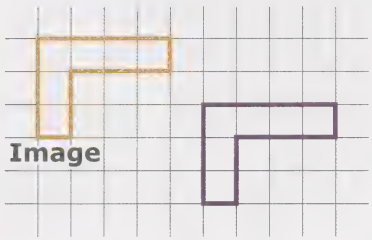
b. 4 units down and 6 units left

- Turn in your workbook to Unit 3, Lesson 13 and complete 5 to 8.

Draw the Image of a Shape after Translation

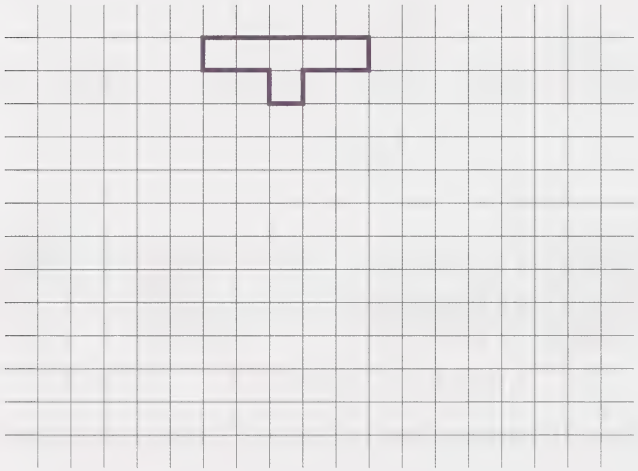
You should also be able to create the image of a shape under a translation. The translation will be described and you need to move all the points.

This is a translation described by: 2 units up and 5 units left

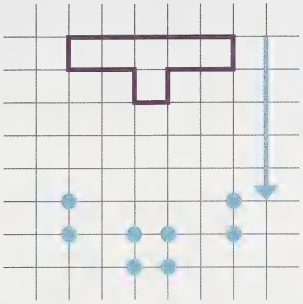


Example 4

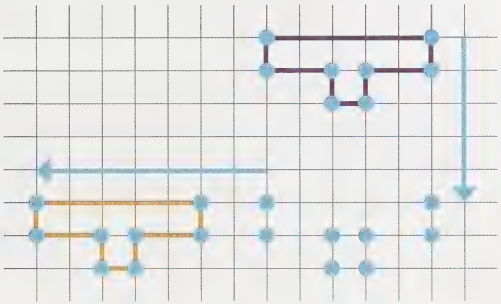
Draw the image of the shape under the translation: 5 units down and 7 units left.



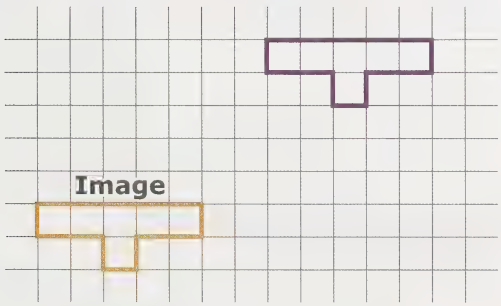
1. Move each point of the figure down 5:



2. Move each point of the figure 7 units left:



3. Label your image:



Let's Practice

- Turn in your Workbook to Unit 3, Lesson 13 and complete 9 to 13.

Lesson 14

Reflections

Photography

Wapta Mountain is one of Cameron's favourite places. He takes pictures of the mountain and of the nature surrounding it. One clear, beautiful day he took a picture that showed the reflection of the mountain in the lake.

Notice how the image of the mountain in the lake is the same size as the mountain above. The shoreline is the dividing point of the real mountain and the image in the water.

Reflection

What is different about the mountain in the water?

Objectives for this Lesson

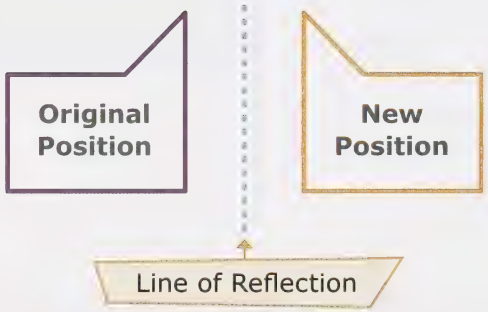
In this lesson you will explore the following concepts:

- Identify the line of reflection for a shape and its image
- Identify the distance of an image from the line of reflection
- Draw the image of a shape reflected over a line

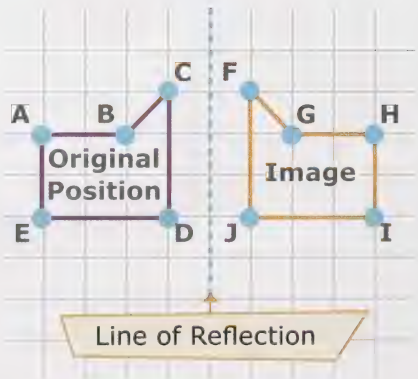
Go online to complete the Concept Capsule about Lines of Symmetry.

Reflection

A **reflection** flips an image over one line. The line is called the **line of reflection**.



The new position of the figure is called the image. Each corresponding point is the same distance from the line of reflection.



Look at point **A** on the original. What is the corresponding point on the image? You should be thinking **H**. Name all the corresponding points:

A corresponds to **H**

B corresponds to **G**

C corresponds to **F**

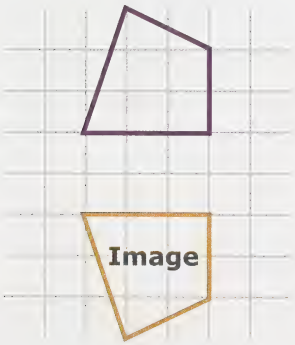
D corresponds to **J**

E corresponds to **I**

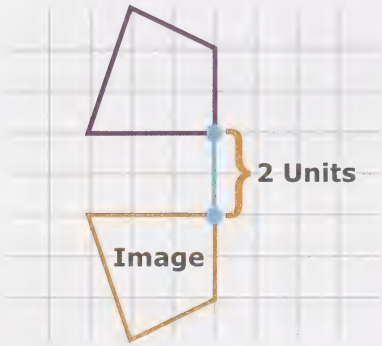
Now look at **C** and **F** in the figure. They are both 1 unit from the line of reflection. **A** and **H** are both 4 units from the line of reflection. You should be able to find that the same is true for all corresponding points on the original and image.

Example 1

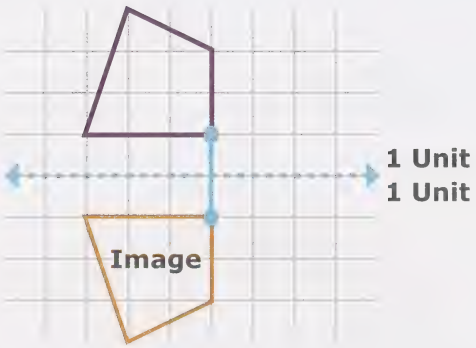
Draw the line of reflection on the picture.



Choose two points that are corresponding on the image and on the original. How many units are there from one to the other?



The line of reflection should be half the distance between these points:



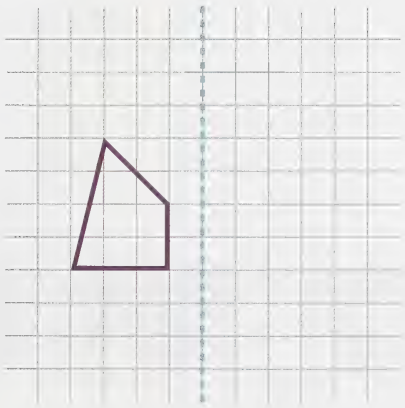
- Turn in your Workbook to Unit 3, Lesson 14 and complete 1 to 10.

Draw the Image of a Reflection

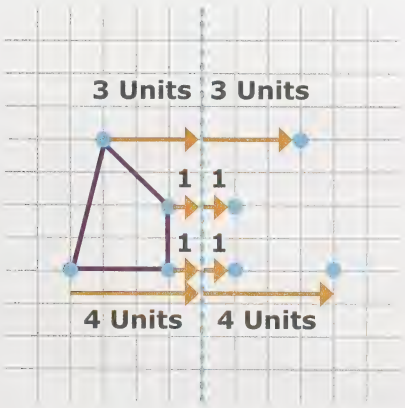
To draw the reflection of a shape to the right of the shape, you will need to reflect each vertex of the original shape over the line of reflection. The distance of the reflection will be described.

Example 2

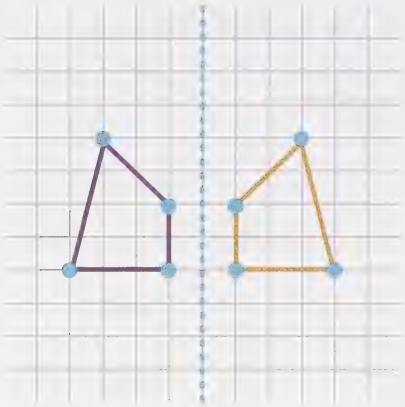
Draw the reflection of the shape over the given line of reflection.



Count the distance from each vertex on the figure to the line of reflection. Draw the corresponding point the same distance on the other side of the line of reflection.



Now connect the dots and your answer is:



Let's Practice

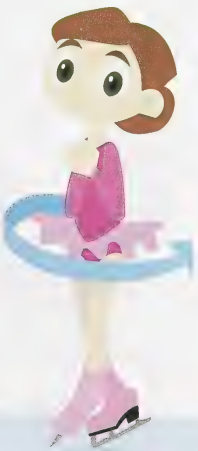
- Turn in your Workbook to Unit 3, Lesson 14 and complete 11 to 15.

Lesson 15

Rotations

Ice Skating

In 1948 Olympic figure skater Barbara Ann Scott won the gold medal for Canada. She was the first Canadian to win the Olympic gold medal for figure skating. In 1942 she landed a double lutz in competition. This is the first time that was ever done by a female. She was only thirteen years old when she did that.



A double lutz is a jump that figure skaters may make during their routine. It involves jumping and rotating in the air. A double lutz means that they rotate their body completely around two times. A triple lutz means that they rotate three times.

Reflection

Can you think of other sports where you would turn or rotate during the sport?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Describe a given rotation about a vertex by the direction of the turn
- Describe a given rotation by the fraction of the turn
- Rotate a given 2-D shape about a vertex given the direction and fraction of a turn

Time

The hands of a clock rotate around the point in the middle where they are attached.

The time is determined by the position of the hands on the clock. This clock displays 9:30:

The minute hand (the long hand) has made a half-turn around the face of the clock. You can call this time "half past 9 o'clock".

If the minute hand is on the 3 that means 15 minutes have passed since the start of the hour. The clock displays:

This time is 9:15 and can be called "a quarter past 9 o'clock". The minute hand has made a quarter turn or a $\frac{1}{4}$ turn.

Reflection

How does the face of a clock relate to fractions?

Rotations

A **rotation** turns a figure about a point. Ice skaters make rotations.

The new position of the object is called the image.

A rotation can be described by two different directions:

Clockwise

Counter-Clockwise

In the picture, look at the direction the arrow is pointing in order to determine the direction.

Example 1

What direction is this rotation?

Think of a clock face over the picture:

Is this the direction that the hands of a clock move? If it is, it is clockwise. Since it is not the direction, it is counter-clockwise.

This rotation is counter-clockwise.

You can also describe rotations as a part of a turn. Just as 9:15 is "a quarter past 9 o'clock" a rotation can be described as a quarter turn. Here are three rotations you should know:

Quarter Turn

Half Turn

Three-Quarter Turn

Think of a circle and how much of a circle each of these is taking up:

$\frac{1}{4}$ $\frac{1}{2}$ $\frac{3}{4}$

The rotation is created by moving each point of the figure the fraction of the turn described.

Example 2

Describe the rotation.

Is the rotation clockwise or counter-clockwise? This one is counter-clockwise.

Is the rotation a $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ turn? Did you notice that the rotation moves corresponding parts from one place to another that can both be along one line?

This is another way of telling that the turn is a $\frac{1}{2}$ turn. You can also imagine a circle over the image:

The turn takes up half of the circle.

The answer is: counter-clockwise $\frac{1}{2}$ turn

Let's Practice

Go online to watch the Notepad Tutor about Describing Rotations.

- Turn in your Workbook to Unit 3, Lesson 15 and complete 1 to 7.

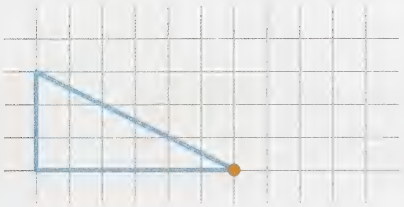
Rotating a Shape

You can rotate a shape by moving the points the distance described.

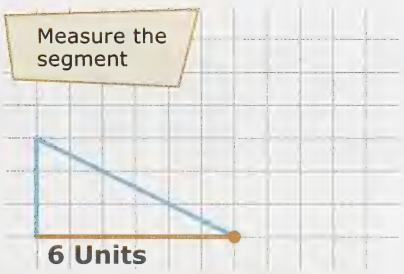
Example 3

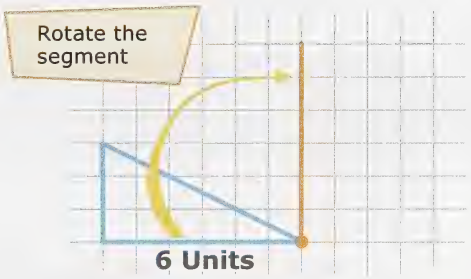
Rotate the shape $\frac{1}{4}$ turn clockwise.

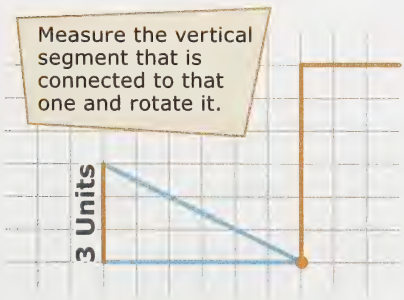
1. Draw the figure on grid paper.



2. Rotate the side that runs along the bottom of the triangle:







3. Connect the endpoints:

Let's Explore

Exploration 1: Rotations

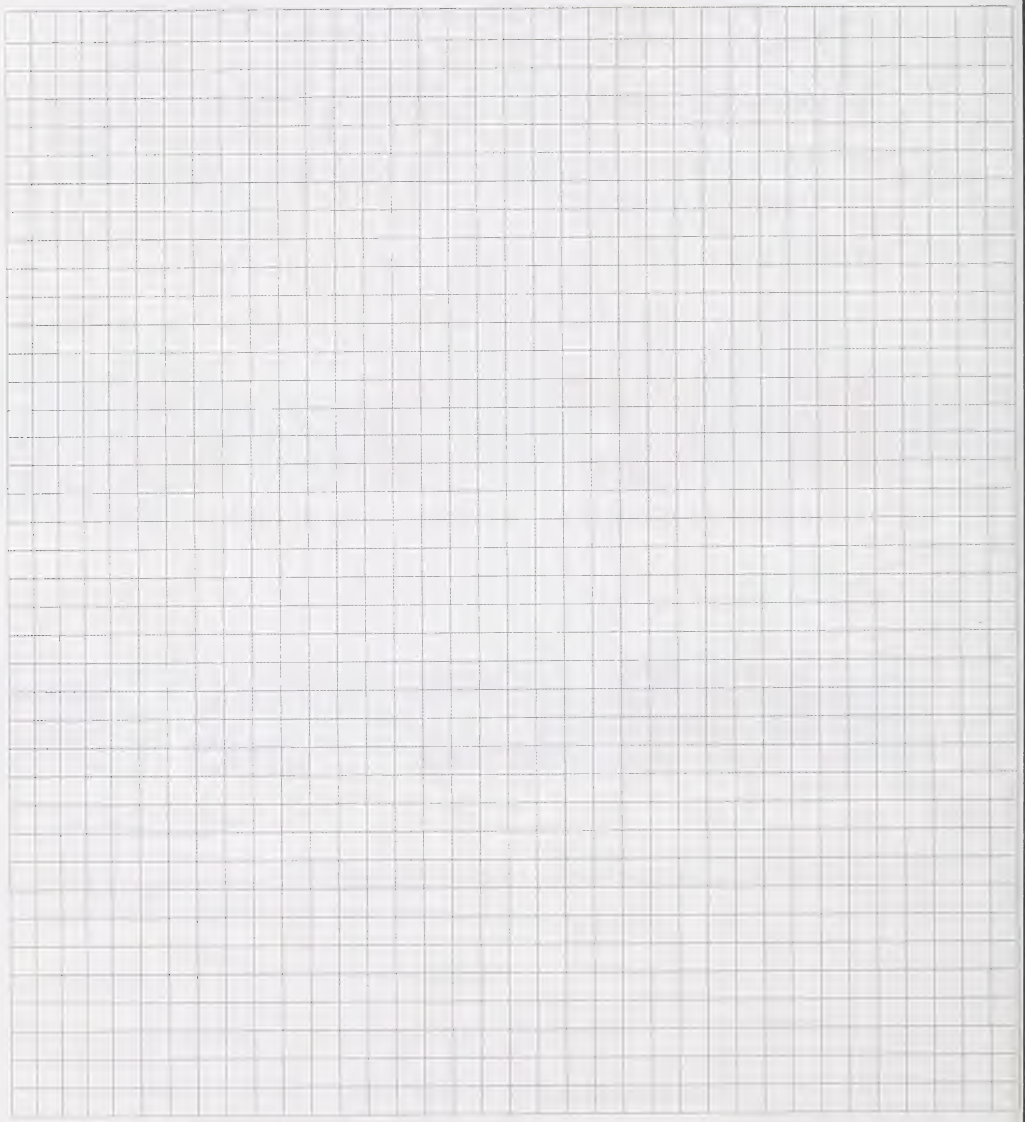
Materials: Unit 3, Lesson 15, Exploration 1 page from your Workbook, Cut-out Shapes from the back of this Unit in your Workbook, Pencil, Scissors, Grid paper

Procedures:

1. Cut out the shapes.
2. Take Shape 1 and place it on the grid paper so that all of the vertices line up with grid lines that cross.
3. Trace Shape 1 onto your grid paper.
4. Now rotate Shape 1 a quarter turn clockwise.
5. Trace Shape 1 again. Write "Image 1" beside the image.
6. Now rotate Shape 1 a $\frac{3}{4}$ turn counter-clockwise.

7. Trace Shape 1 again. Write "Image 2" beside the image.
8. How would you describe the rotation of the original position of Shape 1 to Image 1?
9. How would you describe the rotation of Image 1 to Image 2?
10. How would you describe the rotation of the original position of Shape 1 to Image 2?
11. Place Shape 2 on the grid paper and trace its outline.
12. Have a friend rotate the shape to a new position. Describe the rotation of the original position of Shape 2 to the image.
13. Repeat directions 11 and 12 with Shape 3.
14. Trade with your friend. Move Shape 4 from an original position to an image position. Let your friend describe the translation.

- Turn in your Workbook to Unit 3, Lesson 15 and complete 8 to 10.



Lesson 16

Identifying Transformations

Moving Objects

Objects in the world that move are also a part of mathematics. You can experience translations, rotations and reflections.

When you get on a Ferris wheel you are experiencing a rotation.

When you are sliding down a water slide you are experiencing a translation.

When you are brushing your hair using a mirror you are experiencing a reflection.

Reflection

Can you think of other examples of these concepts?

In this lesson you will explore the following concepts:

- Identify and describe a single transformation
- Provide an example of a translation, rotation and reflection

Transformations

Any change in the position of a shape is called a **transformation**. When you do a translation, reflection or rotation to a shape, you have performed a transformation.

Rotation

Translation

Reflection

To describe a transformation you need to think about the three types you see here.

You are going to find out how the shape of an object will help you describe the transformation.

Exploration 1: Letters and Transformations

Materials: Unit 3, Lesson 16, Exploration 1 page from your Workbook, Pencil, Letters from the back of this Unit in your Workbook, Scissors

1. Cut out the letters. You can cut the rectangle around each. Use your pencil to darken the outline of each letter on the back of the paper.

a b c d e f g h i j k l m n o p q r s t u v w x y z
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

2. Find two lower case letters that are a transformation of the letter d. Describe the transformation of each letter.

3. Which lower case letters can be transformed to create another letter? What transformation must be used to get the new letter?

4. Which upper case letters can be transformed to create another letter?

   What transformation must be used to get the new letter?

   Look at the letter A. If you do a reflection of A over a line of reflection you get the same letter:

5. What other letters can be reflected to form the same letter?

Example 1

Alyssa drew two triangles. One was 4 units below the first. What transformation did she perform?

You can sketch the image to help you out:

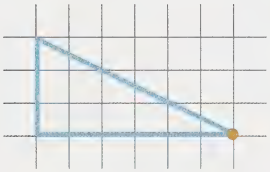
Example 2

Copy the figure on grid paper. Complete the given transformations.

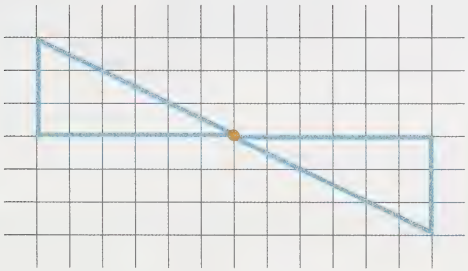
A. $\frac{1}{2}$ turn clockwise B. translation down 1, right 4 C. reflection

A. $\frac{1}{2}$ turn clockwise

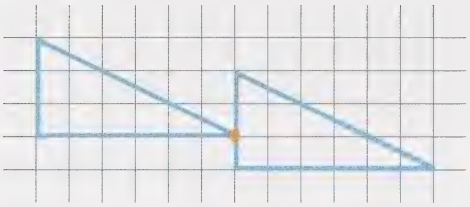
1. Draw the figure on grid paper. Draw the horizontal and vertical sides first:



2. Rotate each point a half turn around the point on the figure.

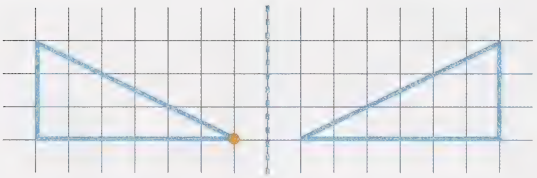


B. translation down 1 right 6



C. reflection

Draw a line of reflection and reflect over that line. There are other answers for this one, depending on where you drew your line of reflection.



Let's Practice

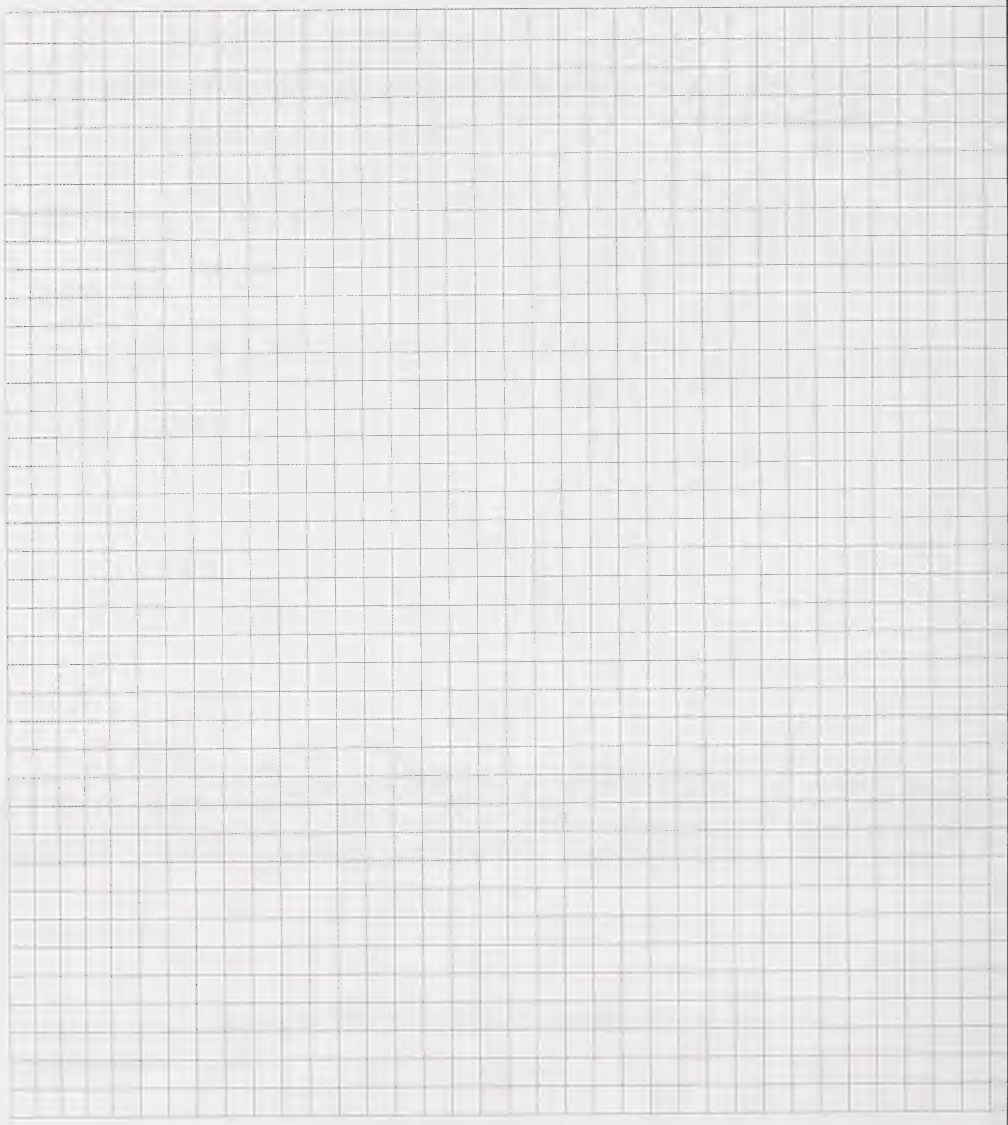
Go online to complete the Concept Capsule about Naming Transformations.

- Turn in your Workbook to Unit 3, Lesson 16 and complete 1 to 13

Go online to complete the Concept Capsule about Describing a Combination of Transformations.

Go online to play a game that will help you review your glossary terms.

Go online to SuccessChecker and complete the Unit test to check your understanding.



Lesson 1

Types Of Data

Hockey

Lian is on an Atom hockey team called the Blades. She keeps a notebook and records the points scored by each player on her team during the season. Here are the results:

Player	Points Scored
Daksha	14
Lian	28
Alyssa	24
Cameron	32

Lian loves hockey so much that she is going to do her research project about the National Hockey League. She looks up the points scored in a season by the following players:

Player	Points Scored
Sidney Crosby	120
Alexander Ovechkin	112
Jarome Iginla	96
Ryan Smyth	70

Reflection

How are these types of data the same?
How are they different?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- The difference between first-hand and second-hand data
- Finding examples of second-hand data in media
- Forming a question that can best be answered using first-hand data
- Forming a question that can best be answered using second-hand data, and explain why

Go online to complete the Concept Capsule about One-to-One vs. Many-to-One Correspondence Graphs.

Types of Data

Data can come from many sources. You can create data through an experiment. You can gather data while observing an event. You can gather data through a survey. These are all types of **first-hand data**. First-hand data is data that is gathered by the person reporting the data.

Data can also come from research. You might look up the statistics of an athlete. You could look up how stocks are doing on a given day. You could find information in an encyclopaedia. This type of data is called **second-hand data**. Second-hand data is not collected directly by the person reporting on the data.

Example 1

Are the following situations first-hand or second-hand data?

A. Zach observes his guinea pigs each day for a week and records the amount of food the pets eat.

Zach gathers the data and will be the reporter of the data. This is first-hand data.

B. Nina looks up the types of energy used in Canada and how much is consumed each year.

Nina is researching to find data that she will report. This is second-hand data.

C. Cameron looks up the amount of plastic and paper recycled each month in his local paper.

Cameron is researching the data he will report. This is second-hand data.

D. Alyssa observes her friends for a month and records the number of times they each forget their pencil or paper for school.

Alyssa is collecting the data herself. This is first-hand data.

Exploration 1: Creating and Researching Data

Materials: Unit 4, Lesson 1, Exploration 1 page from your Workbook, Small package of coloured candies, Plate, Pencil, Computer with Internet access

Creating Data

1. Open your package of candy and empty them on a plate.
2. Sort the candies by colour.
3. Record the colour and number of each candy in a table.
4. Create a bar graph of your results. Remember to mark your scale and write in your colours as categories.
5. What type of data is this? Why?
6. Write three questions for the data in your graph. Answer each question.

Researching Data

7. Find data on the Internet to answer the following question: What are the points earned by the highest scoring NHL hockey

players for the most recent season?

8. Make a table for your data. Look up the scores of at least 4 players.
9. Create a bar graph of the data.
10. What type of data is this? Why?
11. Write 3 questions for the data in your graph. Answer each question.

Questions You Can Support with Data

You can form questions on your own. If the answers to the questions require first-hand data then you must design an experiment or survey to answer the questions. What types of questions can best be answered using first-hand data? Here are a few:

What are the eye colours of the people in my family?

What are the favourite pets of the students in a class?

How many birds did I observe on my hike and what types of birds were they?

You may also need to do some research to answer questions that you formed on your own. Here are a few sample questions that require second-hand data. You can use the Internet or a local publication to answer these types of questions:

What is the country of origin for immigrants to my province?

What type of cell phone service do people in my community use?

What are the most popular charities in my province?

Example 2

What types of data would you use to answer these questions and how would you find the answer?

A. What are the birth rates for the provinces of Canada?
This is second-hand data and can be found through Internet research.

B. What is the most popular chocolate bar in your class?
This is first-hand data and can be found by creating a survey for students in your class.

C. What is the hair colour of people in your neighbourhood?
This is first-hand data and can be found by observing people in the neighbourhood.

D. How many people now use the internet in Canada?
This is second-hand data and can be found through Internet research.

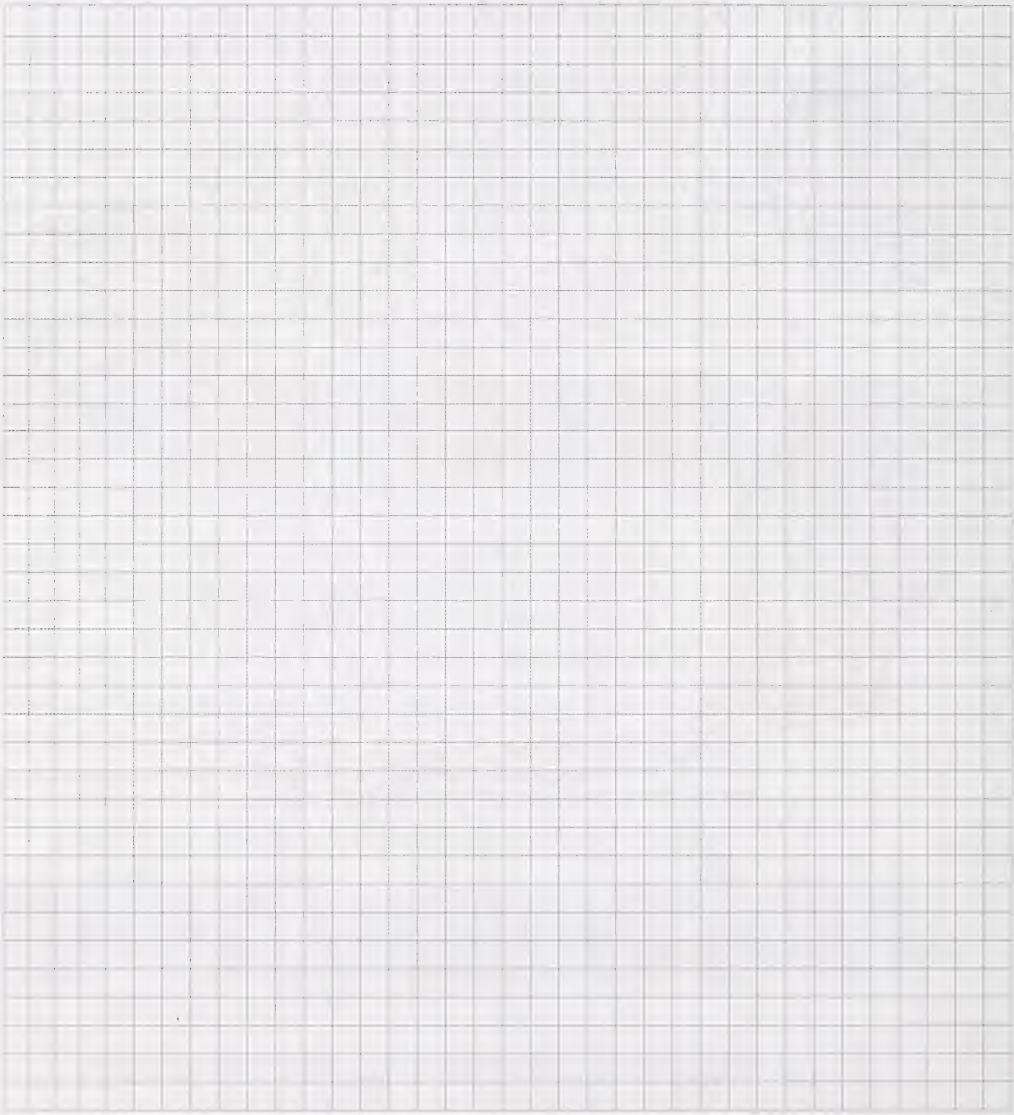
E. How fast does a sunflower plant grow?
This can be first-hand or second-hand data. For first-hand data you would create an experiment where you measure and record the growth of the plant. You could research sunflower plants. You can find information on how fast they grow using a book, gardening journal, or the Internet.

Reflection

Can you think of other questions that can be written for first-hand data? Can you think of other questions that can be written for second-hand data?

Let's Practice

- Turn in your Workbook to Unit 4, Lesson 1 and complete 1 to 16.



Lesson 2

Double Bar Graphs

Sports Survey

Daksha gave the students of his class a survey to determine their favourite sport. He had the boys write their results on red note cards and the girls write theirs on purple note cards:

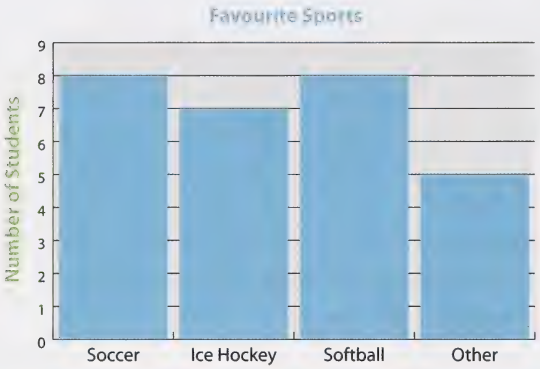
Boy's Results

Soccer	Soccer	Soccer	Soccer		
Ice Hockey	Ice Hockey	Ice Hockey	Ice Hockey	Ice Hockey	Ice Hockey
Softball	Softball	Softball			
Tennis					

Girl's Results

Soccer	Soccer	Soccer	Soccer	
Tennis		Ice Hockey		
Softball	Softball	Softball	Softball	Softball
Volleyball	Volleyball	Volleyball		

To make better sense of the data, Daksha made the bar graph shown:



Reflection

What are the parts of Daksha's bar graph? Can you tell from his bar graph how many girls and boys like each sport? What could Daksha do to make the graph reflect the results for girls and boys?

Objectives for this Lesson

In this lesson you will explore the following concepts:

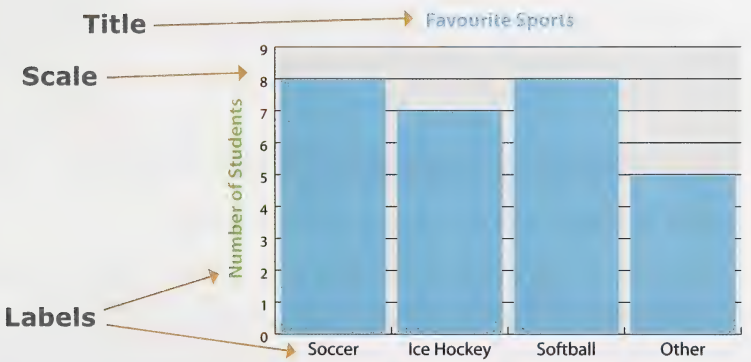
- Interpret double bar graphs to draw conclusions
- Construct double bar graphs

Go online to complete the Concept Capsule about Graphs, Graphs, and More Graphs.

Double Bar Graphs

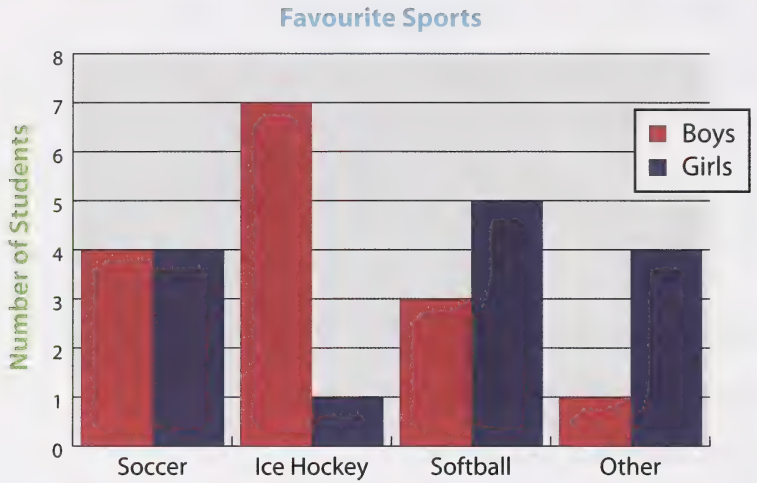
A regular bar graph has the following parts:

- A title that describes the graph
- Labels on axes that describe the categories and the scale of results
- Bars that show a value by their height or length



A double bar graph has all of the same parts. It will also have a series of bars for each category. These bars are usually different colours or patterns. A legend shows what each colour or pattern means.

Here is Daksha's data arranged in a double bar graph.



You can see that this graph shows how many boys favour each sport and how many girls favour each sport.

Here is how you would interpret Daksha's data using the double bar graph.

Example 1

Answer the following questions using the "Favourite Sports" bar graph.

A. How many students were included in the survey?

To answer this question you will need to add the number of students in each bar of the graph:

4 + 4 + 7 + 1 + 3 + 5 + 1 + 4 = 29 students

B. How many students said that softball is their favourite sport?

To find the answer to this question you will need to read and interpret two bars:

3 boys favour softball

5 girls favour softball

To find the number of students that favour softball add the two:
8 students favour softball.

C. How many more boys like ice hockey than girls?

The number of boys that like ice hockey is 7. The number of girls is 1.

Subtract: 7 – 1 = 6

There are 6 more boys than girls that like ice hockey.

Reflection

What other questions could you answer with this graph?

Let's Practice

- Turn in your Workbook to Unit 4, Lesson 2 and complete 1 to 8.

Creating a Double Bar Graph

Drawing conclusions from the data in a bar graph is easier when you have an accurate graph. You will need to know how to create a double bar graph for given data or for data you collect.

From the back of this Unit in your Workbook, pull out a bar graph template and do this example as you read.

Example 2

You are given the following data for Nina and Daksha. They each went hiking this summer and claim to have seen the following:

Animal	Nina	Daksha
Bear	2	1
Elk	3	5
Mountain Goat	6	8
Marmot	9	12

Create a bar graph for the data.

Choose a Title

The title should describe the data of the graph. In this case the data is the number of each type of animal seen on a hiking trip. A good title might be: Animals Observed While Hiking.

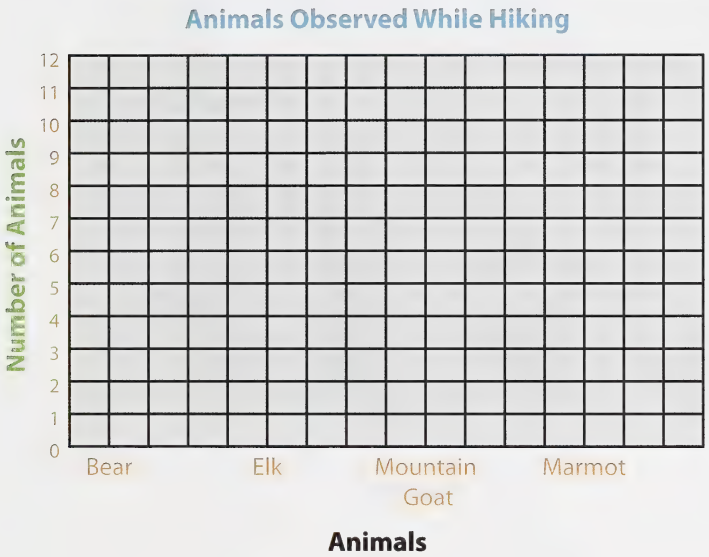
Place the title in the appropriate position on your bar graph page.

Animals Observed While Hiking

Create Labels for Each Axis

The horizontal axis could have the categories of animals. You can use "Animals" as a label.

The vertical axis could describe the type of data. You can use "Number of Animals."



Create a Legend

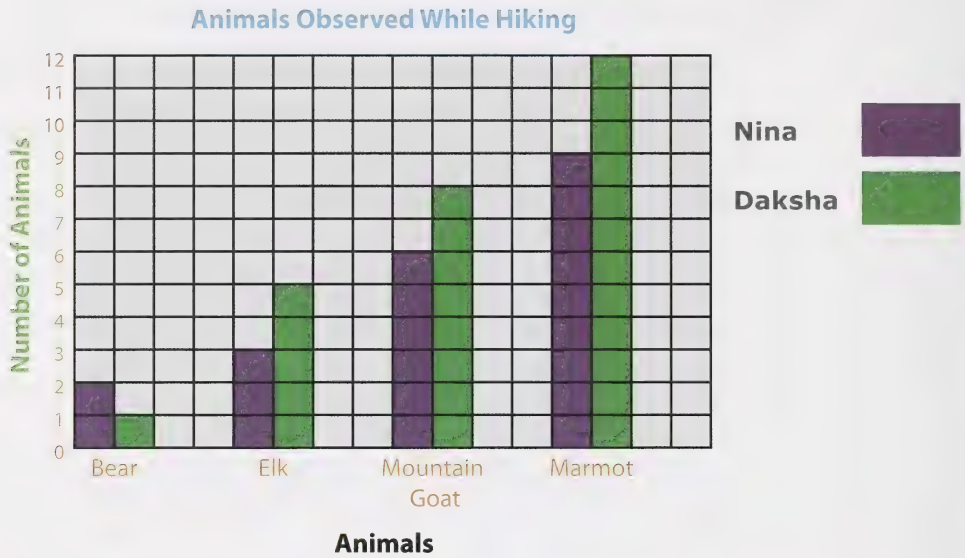
The graph will have two bars for each category: one for Nina and one for Daksha. You will need a legend that shows the colour or pattern for each bar: Place the legend on the right side of the bar graph.

Nina

Daksha

Create the Bars for Each Category

The bars should have the height of the data shown in the table. Use the scale you created to draw your bars the right height. Make the bars the colour or pattern you chose for the legend.



You have created a double bar graph!

Reflection

What types of questions will help you interpret the data of a double bar graph?

Example 3

Use your bar graph for "Animals Observed while Hiking" to answer the following questions:

A. How many animals did Nina and Daksha see all together?

For this one, you need to add up all the bars:

2 + 1 + 3 + 5 + 6 + 8 + 9 + 12 = 46 animals

B. Who saw more bears? How many more?

By looking at the bars for bears you can see that Nina's bar is taller. Now count the number of squares her bar has over Daksha's bar.

Nina saw 1 more bear than Daksha.

C. What is the total number of elk that were seen by Nina and Daksha?

Add up the values for Nina and Daksha's bars:

3 + 5 = 8 elk

D. For which animal is there a difference of 3 observed animals?

Look at the two bars for each category. Find the one that has a difference of three squares filled between the tops.

Marmots

Let's Explore

Exploration 1: Investigator

Materials: Unit 4, Lesson 2, Exploration 1 page from your Workbook, Pencil, Coloured pencils

You are analyzing data for your friend, Alyssa. She is organizing a service group for 11 year olds. She surveyed them on what colour they want for their group shirt. She would like to know the difference between boys and girls in the results. The following are the results:

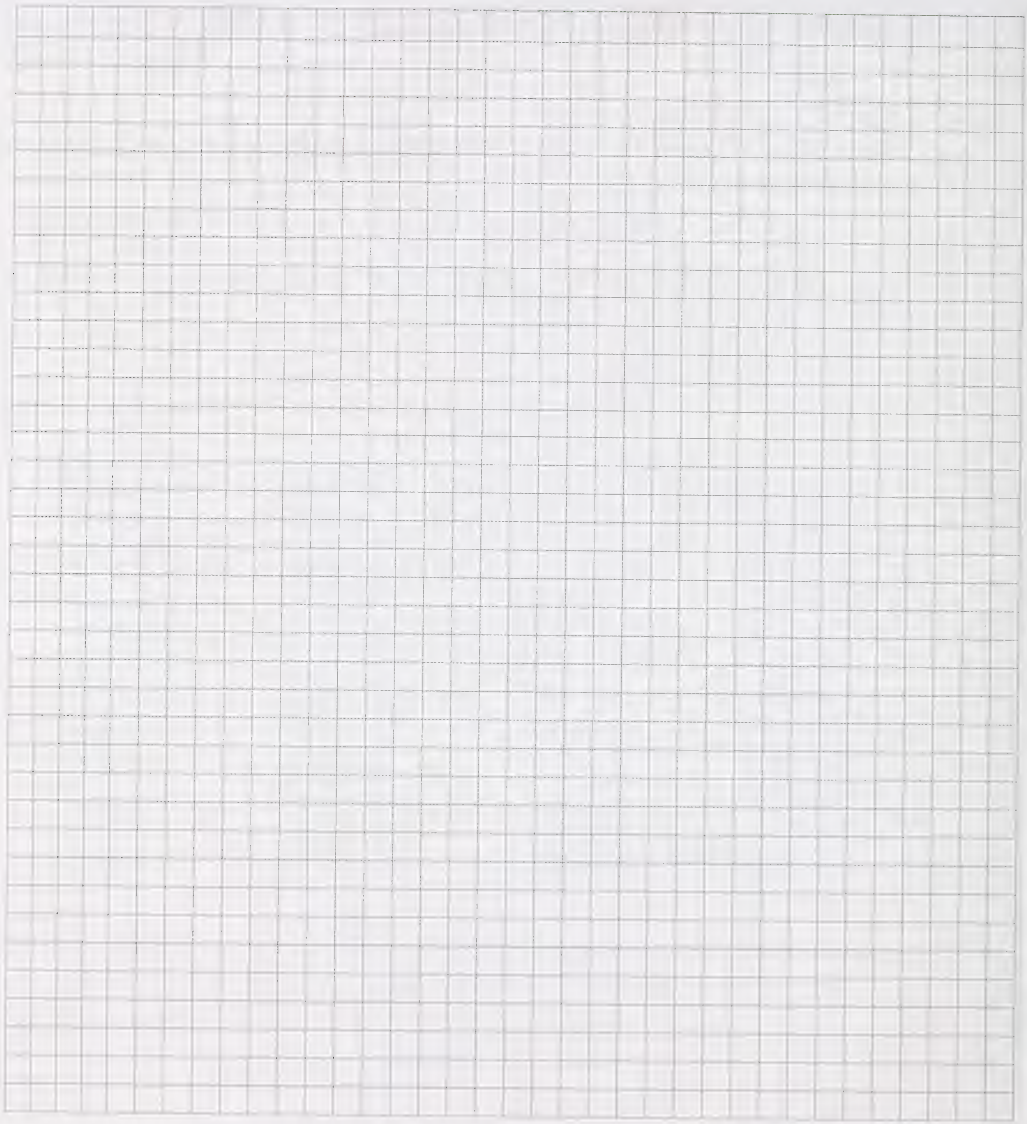
Alyssa	Blue	Michelle	Yellow	Debbie	Green	Julia	Blue
Connor	Blue	Jenny	Green	Josh	Blue	David	Green
Nancy	Red	John	Blue	Cameron	Green	Alexandra	Red
Christine	Blue	Matthew	Red	Jared	Blue	Rob	Green
Wayne	Green	Daksha	Red	Lian	Yellow	Karl	Green
Nina	Yellow	Mary	Green	Karen	Yellow	Louise	Red
Barry	Red	Graham	Yellow	Harvey	Green	Tyler	Red
Jay	Green	Sandra	Red	Carrie	Red	Ryan	Green
Amanda	Yellow	Kathy	Green	Zach	Green	Ingrid	Blue
Elizabeth	Yellow	Kim	Red	Sophie	Yellow	Patrick	Blue

Make a double bar graph of the data and report the results to Alyssa. Suggest to her what shirt colour she should choose based on the survey results.

Let's Practice

Go online to complete the Concept Capsule about Creating Double Bar Graphs.

- Turn in your Workbook to Unit 4, Lesson 2 and complete 9 to 11.



Lesson 3

Describing Outcomes

Who Takes Out the Trash?

Cameron and his younger brother and sister take turns taking out the trash. They each take it out twice per week. On the last day of the week they play "Rock - Paper - Scissors" to decide who will take out the trash.

Cameron and his younger brother have to do a tie breaker. Cameron is upset since he says he ends up losing this all the time.

Reflection

Is it likely that Cameron will take out the trash again? Is it likely that Cameron always loses this game?

Objectives for this Lesson

In this lesson you will explore the following concept:

- Describe the likelihood of a single outcome occurring, using words such as:
  - impossible
  - possible
  - certain

Outcomes

Imagine that you are tossing a coin to make a decision. There are two **outcomes** that may occur:

Tails Heads

An outcome is something that happens. This outcome can be "heads when tossing a coin."

The outcome can be described with the words:

- impossible
- possible
- certain

If an outcome is **certain**, that means it will always happen.

You reach into the box without looking and pull out a coin:

It is certain that you will pull out a penny.

This is certain because ALL of the possible coins are pennies.

If an event is **possible**, that means that there is at least one way for the outcome to happen.

You reach into the following box without looking and pull out a coin.

It is possible that you will pull out a nickel.

It is possible that you will pull out a dime.

It is possible that you will pull out a penny.

If an outcome is **impossible**, that means that there is no way for the outcome to happen.

You reach into the following box without looking and pull out a coin.

It is impossible that you will pull out a dime.

This is impossible because none of the coins are dimes.

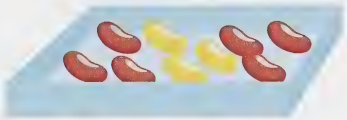
Example 1

Look at the samples. Write whether the outcome is certain, possible, or impossible.

A. the hand landing on red on the spinner

There is one space on the spinner that is red. The outcome is possible.

B. pulling a blue candy out of the box



There are no blue candies in the box. The outcome is impossible.

C. blue on the spinner

The only spaces on the spinner are blue. The outcome is certain.

Exploration 1: Spinners

Materials: Unit 4, Lesson 3, Exploration 1 page from your Workbook, Pencil

Write numbers on the parts of the spinner to fit the given situations.

1. Make each of the following events certain:
   - number is odd
   - number is less than 20
   - number has two-digits

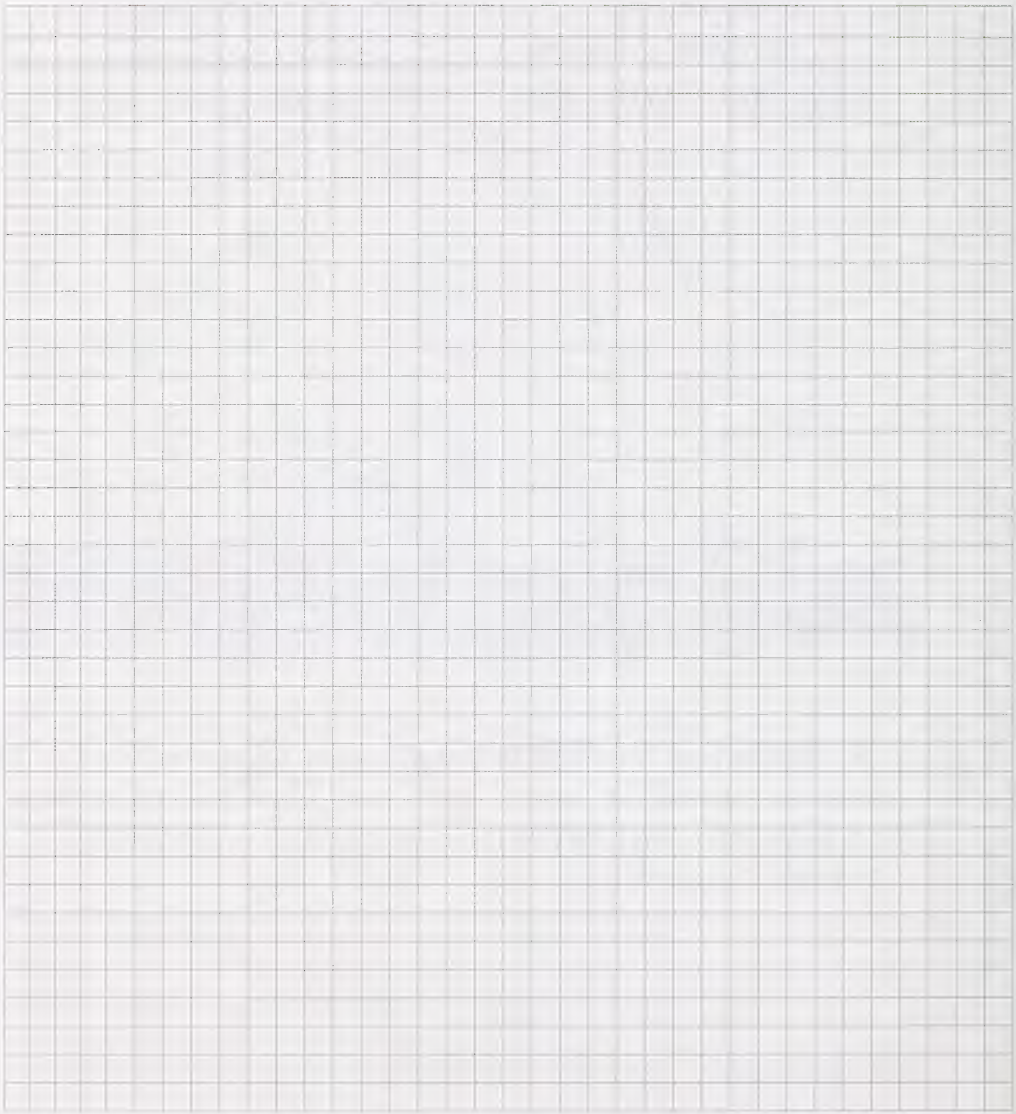
2. Make each of the following events impossible:
   - number is odd
   - number is greater than 20
   - number has two-digits

3. Make each of the following events possible:

- number is even
- number is divisible by 3
- number has two-digits

- Turn in your Workbook to Unit 4, Lesson 3 and complete 1 to 13.

Go online to complete the Concept Capsule about Listing Possible Outcomes.



Lesson 4

Comparing Outcomes

Gymnastics

Lian was stretching to get ready for her balance beam competition. Her coach told her to do her best. Lian had not fallen off the beam in the last three months.

Coach said, "You are **less likely** to fall than you were earlier."

Reflection

What did the coach mean by "less likely?" Why is she less likely to fall?

Objectives for this Lesson

In this lesson you will explore the following concept:

- Compare the likelihood of two possible outcomes occurring, using words such as:
  - less likely
  - equally likely
  - more likely

Likelihood of Outcomes

Outcomes are described as certain, impossible or possible. The outcomes that are possible can be broken down into three categories:

Less likely Equally likely More likely

If an outcome is **less likely** it means that it happens less than half the time.

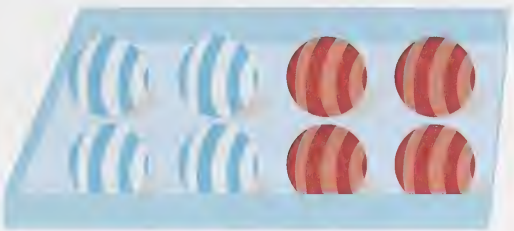
Reach in the box and pull out a red marble.

It is less likely that you will pull out a red marble than a blue marble.

There are only two red marbles in the box. This is less than half of the eight marbles that are in the box.

If an outcome is **equally likely** then exactly half of the time it is possible.

Reach in the box and pull out a red marble.



It is equally likely that you will pull out a red marble instead of a blue marble.

Both the red and blue marbles make up half of the eight marbles.

If an outcome is **more likely** then it happens more than half the time.

Reach in the box and pull out a red marble.

It is more likely that you will pull out a red marble than a blue marble.

The red marbles make up more than half of the group.

Now It's Your Turn

Describe each event as more likely, equally likely, or less likely.

a. pulling out a square b. pulling out a circle c. pulling out a blue shape

Solutions

a. more likely b. less likely c. equally likely

Comparing Outcomes

You may also need to be able to compare more than two objects in a set.

Let's Explore

Exploration 1: Bag of Coins

Materials: Unit 4, Lesson 4, Exploration 1 page from your Workbook, Many coins of different sizes, Small paper bag, Pencil

For 1 – 3: Use more than two types of coins in your bag.

1. Put coins in a bag so that it is less likely to draw a penny. List the coins you used.
2. Put coins in a bag so that it is equally likely to draw a penny. List the coins you used.
3. Put coins in a bag so that it is more likely to draw a penny. List the coins you used.

For 4 – 8: Create a bag with 12 coins using pennies, nickels, dimes, and quarters.

4. Describe the contents of your bag.
5. What coin are you most likely to pull out of the bag.
6. What coin are you least likely to pull out of the bag.
7. Draw a coin out of your bag 50 times and record the results in the table using tally marks.
8. Do your results match your answers to numbers 5 and 6? Why or why not?

Example 1

Use the spinner to describe the event as less likely, equally likely or more likely.

A. spinning a red

The spinner has 6 spaces. There are 3 that are red. That is half of the spaces so it is equally likely that you will spin a red.

B. spinning a green

The spinner has 1 space that is green. This is less likely than the blue or the red.

C. spinning an even number

The spinner has only one odd number on the spaces. It is more likely that you will spin an even number.

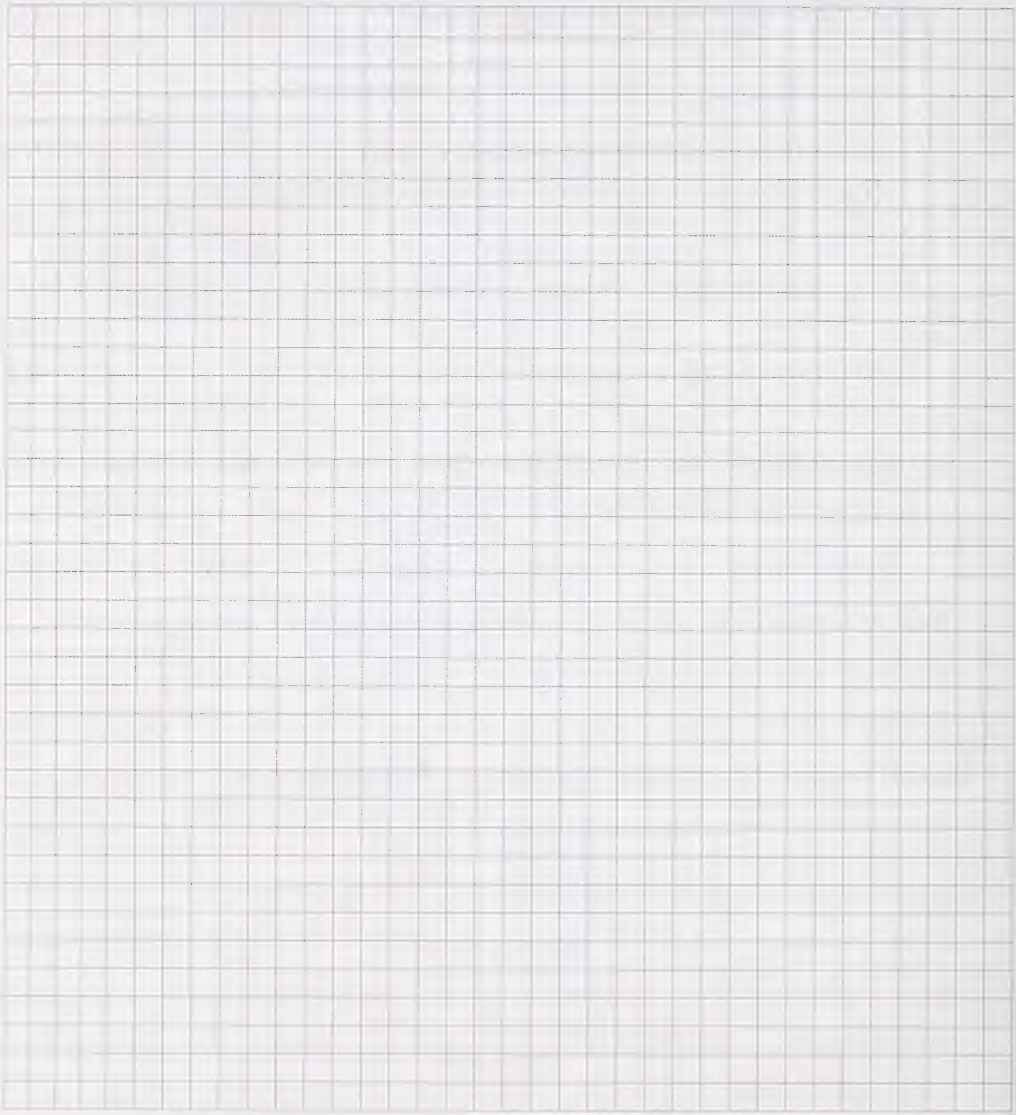
Let's Practice

Go online to watch the Notepad Tutor about Comparing Outcomes (Less Likely, Equally Likely, More Likely).

- Turn in your Workbook to Unit 4, Lesson 4 and complete 1 to 13.

Go online to play a game that will help you review your glossary terms.

Go online to SuccessChecker and complete the Unit test to check your understanding.

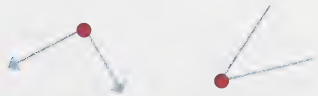


Glossary

A

angle: Two parts of a line with a common endpoint form an angle.

formed by two rays formed by two segments



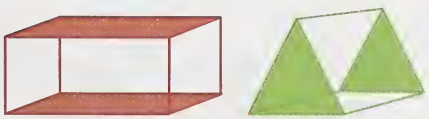
annexing: An estimation strategy used with multiples of 10 that involves dropping the 0 and replacing it in the end.

80 x 9
8 x 9 = 72
80 x 9 = 720

area: The number of square units it takes to cover a shape.

B

base: The two faces of a prism that are congruent and parallel.



The bases are shaded

C

capacity: A measure to show how much is contained in an object.

certain: Sure to happen.

It is **certain** you will reach into this box and pull out a coin.

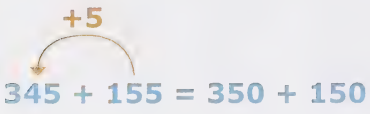
coefficient: The number in front of a variable that indicates multiplication.

4x = 12
↑
coefficient

compatible numbers:
Compatible numbers are numbers that are close to the original numbers in the problem.

127 + 238
= 130 + 240
= 370

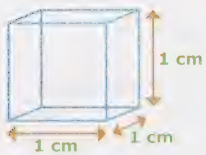
compensation: An estimation strategy that involves borrowing from one number and giving to another.



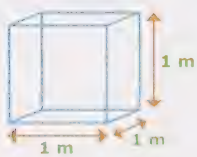
congruent: Figures that are the same size and shape.

consecutive angles: Angles of a polygon that have one side in common.

cubic centimetre: A unit of measure for volume.

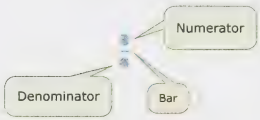


cubic metre: A unit of measure for volume.



D

denominator: The number in a fraction that is below the fraction bar. It represents the total number of items in a group.



digit: One of the ten symbols used to write numbers: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

456

3 digits: **4, 5, and 6**

distributive property: The property that states that multiplying a number by a sum is the same as multiplying a number by each number in the sum.

Multiplying by a sum	Multiplying with Distributive Property
$4(15 + 8)$ $= 4\ (23)$ $= 92$	$4(15 + 8)$ $= 4\ (15) + 4(8)$ $= 60 + 32$ $= 92$

dividend: The number being divided in a division problem.

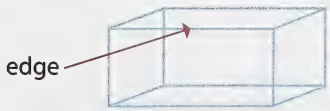
divisor: The number you are dividing by in a division problem.

doubles: Numbers that are generated by multiplying the number times itself.

$2 \times 2 = 4$
$3 \times 3 = 9$
$4 \times 4 = 16$

E

edge: A line segment where two sides come together.

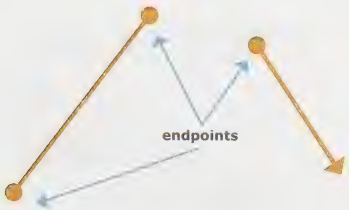


element: One of the terms or numbers or objects in a pattern or a set.

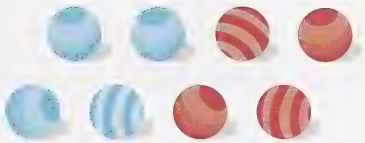
A	B
2	10
4	20
6	30
8	40
10	50

4 is an element of A

endpoints: A point that marks the end of a ray or a line segment.



equally likely: Possible exactly half of the time.



It is **equally likely** that you will select a red marble.

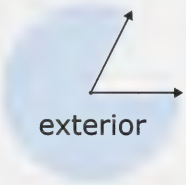
equation: A math sentence that shows two quantities are equal.

$x + 3 = 9$

expanded form: A number written with the value of each digit shown.

$156 = 100 + 50 + 6$

exterior of an angle: The space on the outside of the two rays or segments of an angle.



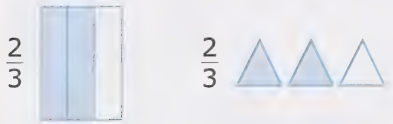
F

face: The flat side of a prism.

A face is shaded.

first-hand data: Data that you gather during a study.

fraction: A number that names part of a whole or a group.



front-end rounding: An estimation strategy in which the number is rounded to the largest place value digit.

283
front-end rounds to: 200

G

generalization: A rule for a pattern found by observation.

A	B
2	10
4	20
6	30
8	40
10	50

A relates to B with the rule A x 5 = B

graduated cylinder: A cylinder that has unit markings along the side; used to measure capacity.

greater than: The > symbol that shows that two numbers are not equal. The number in front of the symbol is greater than the number after the symbol.

H

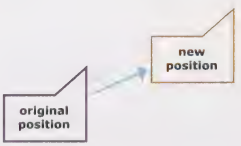
halving and doubling: The method of multiplying that involves taking half of one number and doubling the second to make an easier problem.

25 x 62
double ↓ ↓ half
= 50 x 31
= 1 550

horizontal: A line that extends left and right.

I

image: The new position of the original figure in a transformation.



impossible: That cannot happen or be done.

It is **impossible** for you to reach into this box and pull out a quarter.

inequality: Two expressions that are not equal. The symbols <,>, and ≠ are used to show an inequality.

< > ≠

interior of an angle: The space in between the two rays or segments of the angle.

intersecting: Geometric figures that cross each other.

intersecting lines

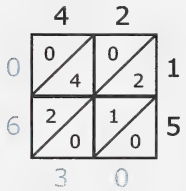
inverse: Operations that undo each other. The inverse of addition is subtraction. The inverse of multiplication is division.

Subtraction is the inverse of Addition:
5 + 9 = 14 14 - 9 = 5

Division is the inverse of Multiplication:
5 x 3 = 15 15 ÷ 3 = 5

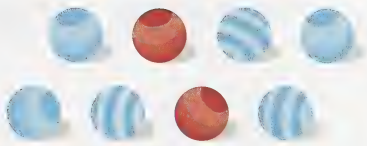
L

lattice multiplication: A method for multiplying numbers with two or more digits that uses a lattice diagram.



42 x 15 = 630

less likely: Possible less than half the time.



It is **less likely** that you will select a red marble.

less than: The < symbol shows that two numbers are not equal. The number in front of the symbol is less than the number after the symbol.

line: A line is a straight path that goes on forever in opposite directions.

line of reflection: The line that the image is reflected over for a reflection.

line segment: Part of a line that has two endpoints.

M

mathematical expression: Sums and products of variables and numbers.

$2 + x$

millimetre: A unit of metric measure for measuring length.

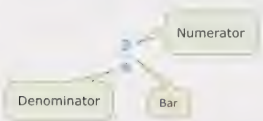
1 millimetre = 10 centimetres

more likely: Possible more than half the time.

It is **more likely** that you will select a red marble.

N

numerator: The number above the bar in a fraction. It describes the number of parts of the whole.



O

operation: Addition, subtraction, multiplication or division.

5 + 12 = 17

addition is the operation

opposite angles: Angles of a polygon that do not have a side in common.

outcome: The result of an experiment.

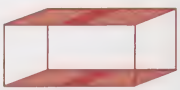
The two outcomes from flipping a coin are: tails or heads.

P

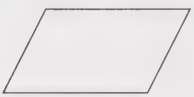
parallel: Two lines that never meet.

Parallel Lines

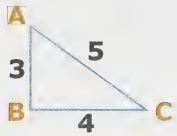
Parallel Faces



parallelogram: A quadrilateral with opposite sides parallel.



perimeter: The distance around an object.



The perimeter is 3 + 4 + 5 or 12 Units

perpendicular: Two lines that form a 90° angle.

Perpendicular Lines

Perpendicular Faces

place value: The value of a digit in a number.

4 623

the value of the 4 is 4 000
the value of the 6 is 600
the value of the 2 is 20
the value of the 3 is 3

polygon: Closed shapes made of 3 or more line segments that do not cross.

pentagon

hexagon

octagon

possible: That may happen or be done.

It is **possible** that you will reach into this box and pull out a dime.

prism: A 3-D shape that has two equal and parallel faces, with their vertices joined.

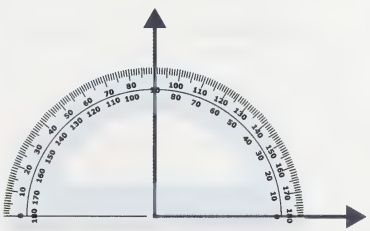
properties: Statements that describe a shape.

property: True mathematical statement.

Multiplying
with Distributive Property

$4(15 + 8)$
$= 4\,(15) + 4(8)$
$= 60 + 32$
$= 92$

protractor: An instrument for measuring the size of an angle in degrees.



pyramid: A three dimensional object with one base, and faces that meet at a single point.

Q

quadrilateral: A four sided polygon.

quotient: The answer to a division problem.

Quotient → 14
6)84

R

reflection: A transformation that flips an image over one line.

relation: A group of numbers that follow a pattern.

A	B
2	10
4	20
6	30
8	40
10	50

The table of values shows a relation.

relationship: A connection between numbers in a pattern.

A	B
2	10
4	20
6	30
8	40
10	50

The relationship of A to B is A x 5 = B.

remainder: The amount left over when a number cannot be divided equally.

9 ÷ 2 = 4 R 1

right angle: An angle measuring 90 degrees.

rotation: A transformation that turns a figure about a point.

S

second-hand data: Data that is collected by research.

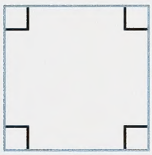
sequence: A set of numbers that follow a pattern.

2, 5, 8, 11, 14, 17
is a sequence that follows the rule "add 3"

skip counting: A method of counting that involves skipping some numbers.

skip counting by 7s: 7, 14, 21, 28, 35...

square: A quadrilateral that has four equal sides and four right angles.



standard form: A number written with spaces between periods.

The number one-thousand two hundred forty-three is 1 243.

Thousands		Hundreds	Tens	Ones
1		2	4	3

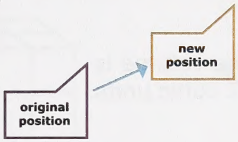
standard unit: Units of measure that are used in most countries.

Metres, centimetres and millimetres are Metric units of measure.

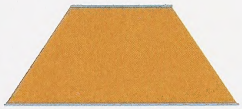
T

transformation: A change in the position or orientation of a shape.

translation: Movement of a figure along a straight line.



trapezoid: quadrilateral that has one pair of parallel sides.

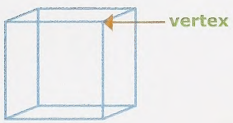


V

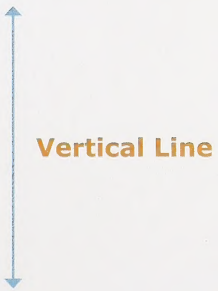
variable: A symbol used to represent a number.

2 + x
x is a variable

vertex: The point of meeting of lines that form an angle.

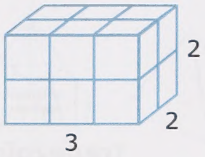


vertical: A line that extends up and down.



volume: The amount of space a solid occupies.

The volume is 12 cubic units.



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